DuPont Technical Assessment on

U.S. Army Newport (Indiana) Project

Executive Summary

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TRANSPORTATION SAFETY ASSESSMENT AND RISK MANAGEMENT PLAN

Statement of Purpose

DuPont has performed a thorough transportation safety assessment, considering these critical transportation factors:

1. Hazards of the wastewater material
2. Design requirements of the transportation equipment
3. Features of various transportation route
4. Transportation risks

There would be no transportation of VX nerve agent. If the Army awards the contract to DuPont, wastewater (Newport Caustic Hydrolysate, or NCH) will be transported from Newport, Indiana, to the DuPont SET facility in Deepwater, New Jersey. The NCH wastewater will be certified as having no detectable levels of nerve agent present, using the state of the art analytical techniques.

Methodology

This transportation safety assessment was consistent with existing methodologies developed or used by various government agencies, including the U.S. Department of Transportation's Risk Management Self-Evaluation Framework (RMSEF), and the Guidelines for Chemical Transportation Risk Analysis published by the Center for Chemical Process Safety.

VRiskMap, a commercially available Geographic Information System offered by Visual Risk Technologies (Nashville, TN), was used in the evaluation of various transportation route options.

Key Findings

- The wastewater (NCH) does not pose any unique or new concerns in transportation. NCH is a medium-hazard material, defined as Corrosive, Packing Group II, by the U.S. Department of Transportation (DOT). Several household products, including drain and oven cleaners, are classified similarly (or at a higher hazard level).
- The transportation equipment to be used for this project meet or exceed DOT requirements.
  - Tank trucks are built to the American Society of Mechanical Engineers (ASME) standards and have a higher Maximum Allowable Working Pressure (MAWP) than required by DOT. This means that they are more robust than is required, having a thicker wall on the container, which would provide additional protection during an accident.
  - DOT specifies many important features of the tanks, including material of construction, thickness of material, pressure relief systems, emergency valve shut-off, and accident damage protection for valves and other fittings. The tanks to be used for transportation meet or exceed these requirements.
- All transportation options have equivalent and low chances of accident or release.
  - Less than one accident and significantly less than one release would be statistically predicted with loaded tank trucks over the *entire* project. There is roughly a 1 in 3,000 chance of a truck accident per trip or a 1 in 13,000 chance of a release of product per trip.
- The transportation of NCH poses only a moderate hazard to emergency responders and other persons in the immediate vicinity of the spill (range of 30-50 yards), and is very unlikely to have wide-reaching effects on population or the environment. Overall, the potential consequences from a spill are low and do not differ from other potential spills of other commercially transported, corrosive materials.

Conclusions

- The wastewater being transported for this project does not pose any unique or new concerns in transportation. The risks along all of the identified routes are very low to populations, employees, emergency response personnel, and the environment due to transport of NCH. (see Figures 1 and 2)

- The routes, carriers, and transportation equipment were carefully selected to even further reduce that risk, and result in a very low chance of an accident or a release of material.
- In order to further assure safe shipment of the material, DuPont's risk management plan includes:
  - Thorough safety qualification of carriers and selection of the best in industry, qualifications which must be maintained over the entire shipping campaign
  - Dedicated fleet of drivers and equipment for transportation
  - Team drivers to reduce transit time and layover, and provide added security
  - Global Positioning Systems (GPS) in every truck for communication and security
  - Late-model, high-quality equipment
  - Speed governors to restrict maximum travel speed
  - Trailers built to ASME boiler code standards

DuPont's Preferred Route

The identified preferred route, (No. 1 in the chart below):

- utilizes the most interstate highways – enhancing its statistical safety ratio
- minimizes travel over waterways – enhancing the water "exposure" metric
- is the most efficient in coordinating emergency response capabilities among DuPont responders and appropriate state and local responders

In the event of weather, traffic or other issues affecting the preferred route, an alternative route has been identified (No. 2 in the chart below) based on several comparable criteria.

Public comments and input on the transportation routes are available as part of the current public comment process and at the upcoming public information sessions.

Figure 1: Map of Four Potential Highway Routes

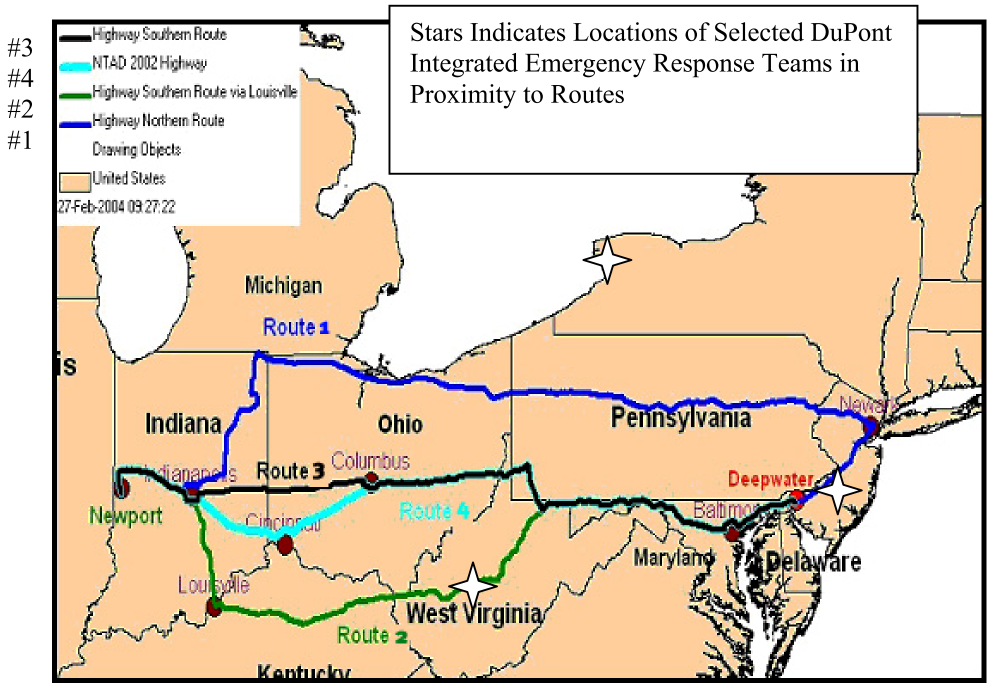
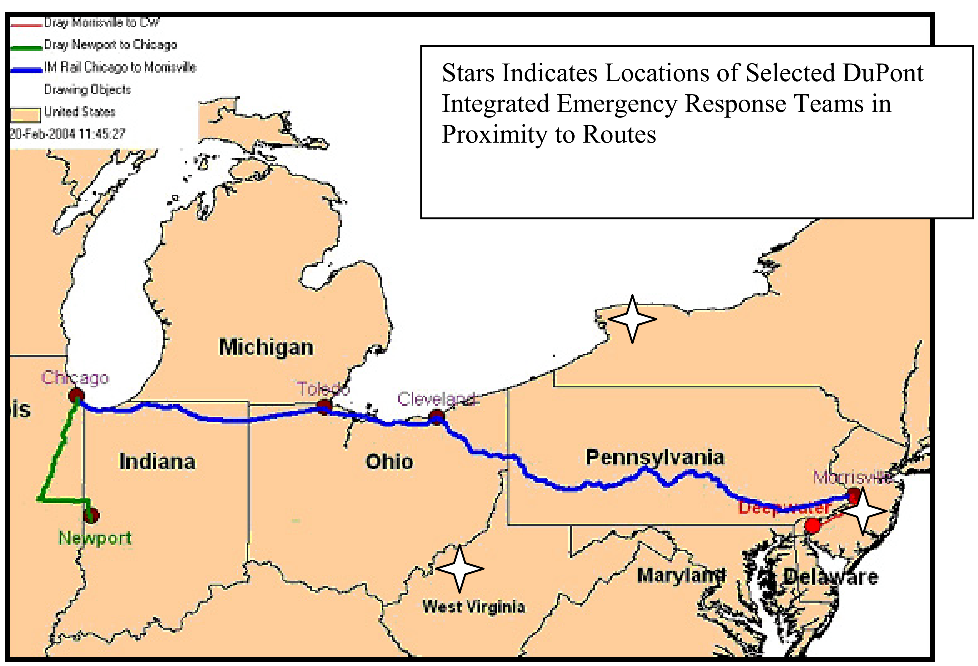


Figure 2: Map of Potential Highway-Rail Intermodal Route (#5)



TREATABILITY STUDY

Statement of Purpose

The objective of this study was to determine if the SET Wastewater Treatment Plant (WWTP) at the Chambers Works site (Deepwater, NJ) could effectively treat Newport (Indiana) Caustic Hydrolysate (NCH) at the U.S. Army's anticipated generation rate. Currently, the SET facility treats approximately 15 million gallons of wastewater per day. The approximate production rate of NCH is anticipated to be one to two truckloads (a total of 3,000 to 7,000 gallons) per day.

The study evaluated both pretreatment through chemical oxidation as well as biotreatment utilizing the patented PACT® process (Powdered Activated Carbon Treatment with activated sludge).

In the study, three general criteria for the effective treatment of NCH were used:

- Ability to meet SET WWTP operational requirements
- Ability to maintain control of wastewater and sludge odors
- Ability to assure permit compliance

Methodology

Pretreatment by chemical oxidation was conducted to evaluate dosages and operating conditions. A biotreatability study was conducted using continuously fed Eckenfelder-type PACT® bioreactors.

Over the history of the SET WWTP, DuPont has demonstrated the suitability of this scale of testing to screen wastewaters for acceptance. Eckenfelder-type reactors have been used by DuPont to design several of its wastewater treatment systems currently in operation. The bioreactors were operated to simulate the conditions at the WWTP using actual wastewater and activated sludge under plant process conditions. Several wastewater parameters were monitored in the influent and effluent to each bioreactor including dissolved organic carbon (DOC), biochemical oxygen demand (BOD), chemical oxygen demand (COD), ethyl methyl-phosphonic acid (EMPA), methylphosphonic acid (MPA), and other parameters. Reactor conditions such as pH, temperature and mixed liquor suspended solids (MLSS) were monitored and controlled at levels similar to those maintained in the full-scale SET WWTP.

Key Findings

Key findings of the treatability study include:

- The DuPont WWTP can effectively treat the stated volume (3,000 to 7,000 gallons per day) of NCH generated at the Newport (Indiana) site. In addition, the bioreactor system operated within normal SET WWTP operating conditions at a NCH production rate of up to 10,000 gallons per day.
- Pretreatment by chemical oxidation was effective in odor control. Odor intensity results were indistinguishable between the wastewater and sludge in the control and those from the test streams.
- Chemical oxidation pretreatment destroys the thiolamine, but has limited effect on EMPA and MPA. Biotreatment will convert a substantial portion of EMPA to MPA while overall treatment of MPA will be limited. EMPA and MPA at the estimated levels are not toxic to aquatic organisms in the Delaware River and Estuary.
- Following biotreatment at the WWTP, no other organic components or degradation products of the NCH were identified in the bioreactor effluent.
- Solid residues generated from the treatment of NCH will be placed in DuPont's on-site RCRA permitted subtitle "C" landfill, not in public landfills
- The study demonstrated that key permit parameters such as BOD_5, percent BOD removal and Whole Effluent Toxicity for the WWTP would be met during the treatment of the NCH.
- Modeling of the physical parameters indicates that no atmospheric emissions of MPA, EMPA or thiolamine would result from the treatment of NCH.

Conclusions

This treatability study conclusively demonstrates that all three major success criteria can be met and the SET WWTP can safely and effectively treat the NCH.

SCREENING LEVEL ENVIRONMENTAL RISK ASSESSMENT

Statement of Purpose

The objective of this review is a screening level environmental risk assessment for the effluent discharge to the Delaware River and Estuary resulting from the waste treatment of Newport (Indiana) Caustic Hydrolysate (NCH) by the DuPont Secure Environmental Treatment (SET) wastewater treatment plant (WWTP) located at Deepwater, New Jersey. This assessment evaluated the environmental exposure pathways and screening level risk to ecological receptor species in the Delaware River and Estuary.

Methodology

U.S. EPA risk assessment guidance was used in the development of this assessment (U.S. EPA 1997). Screening level exposure and hazard characterizations were developed for EMPA and MPA, the principal constituents of the SET WWTP effluent that result from the treatment of NCH. These exposure and hazard characterization data were then used to develop risk quotients that were evaluated to assess risk to the receptor species.

The following information was considered in this process:

- Physical/chemical properties of EMPA and MPA
- Estimated effluent concentrations for EMPA and MPA from the study of NCH treatability (Reich et al. 2004)
- Physical mixing properties for the SET WWTP effluent discharge in the Delaware River
- Experimental and modeled aquatic toxicity data for EMPA and MPA using representative, sensitive aquatic species

Findings

- The primary environmental exposure pathway for MPA and EMPA is surface water. Based on their physical-chemical properties, EMPA and MPA are not volatile (no airborne exposure) and do not bioaccumulate (do not build up in organisms or the food chain).
- Phosphonic acids are present in the environment from naturally occurring and industrial sources.

- EMPA and MPA at anticipated discharge concentrations are not toxic to aquatic organisms in the Delaware River and Estuary.
- In surface water, EMPA will naturally biodegrade into MPA and ethanol. The low levels of ethanol released will be used as a food source by microorganisms and will not pose a hazard to the environment.
- Biological processes will eventually biodegrade MPA to inorganic phosphate and methane.
- Based on the low concentrations of MPA and the limited bioavailability of its phosphorus content, no significant addition of phosphorus will occur in the estuary. Any utilization of the phosphorus in MPA as a nutrient for plant growth is likely to occur in phosphorus-limited areas of the open ocean.

Conclusion

The screening level risk assessment indicates that discharge of effluent from the treatment of NCH by the SET WWTP will have no adverse effect on the environment.

TOXICOLOGY ASSESSMENT OF HEALTH HAZARDS

Statement of Purpose

A toxicology assessment was conducted to evaluate the potential human health hazards and risk relevant to transportation of NCH from Newport, Indiana to Deepwater, New Jersey and subsequent treatment at the DuPont Secure Environmental Treatment (SET) wastewater treatment plant (WWTP) located at Deepwater, New Jersey.

Methodology

The wastewater (NCH) is a water-based mixture containing 80% water and the following compounds: diisopropylamino ethylthiolate (thiolamine), sodium ethyl methylphosphonate, sodium hydroxide, sodium methyl phosphonate, ethanol, diisopropylamino ethyl disulfide and diisopropylamine.

All currently available information on the NCH mixture physical properties, exposure scenarios, toxicity and regulatory standards were evaluated and used to assess the human health hazard/risk potential of NCH during transportation. The NCH toxicological assessment was conducted on the complete NCH mixture.

One of the NCH components, thiolamine, is in the mercaptan chemical family and has an odor, which can be detected at very low concentrations. However, thiolamine will be completely destroyed during treatment at the SET facility. A toxicological assessment was conducted for the residual methylphosphonic acid (MPA) and ethyl methylphosphonic acid (EMPA) expected to remain following NCH treatment at the SET facility.

Additional toxicity testing and modeling were conducted to complement the available information in the MPA and EMPA toxicity databases. The assessment included the following activities.

- Reviewed U.S. Army reports related to the composition, chemical and toxicological properties of NCH
- Comprehensively searched Toxline, Medline, Toxnet and Scifinder 2004 databases for toxicity information on NCH components, including MPA and EMPA and similar compounds

- Reviewed the American Industrial Hygiene Association (AIHA) Emergency Response Planning Guides (ERPGs) for sodium hydroxide, the component of NCH which drives the toxicity considerations
- Conducted dermal toxicity tests on NCH required for DOT corrosivity classification
- Conducted predictive toxicity and metabolism modeling of EMPA and MPA using METEOR, DEREK and TOPKAT programs
- Conducted acute oral toxicity tests on MPA and EMPA

Key Findings

- NCH is a water-based liquid with very low vapor pressure. Using DOT definitions, NCH is not a poison or acutely toxic material, but it is considered to be a corrosive material due to the presence of sodium hydroxide (pH 12-14).
- NCH presents no unique physical or chemical hazards as compared to other corrosive sodium hydroxide (lye) waste materials.
- Dermal and eye exposure to NCH liquid and inhalation of NCH droplets are the most relevant exposure considerations for people in the immediate vicinity of a NCH release, such as those involved in emergency response or clean up activities.
- Predictive toxicity models were uninformative, but metabolism modeling indicated that MPA and EMPA are not metabolized in humans.
- Based on acute oral toxicity tests, MPA and EMPA had approximately the same order of acute toxicity as table salt.

Conclusion

An assessment of NCH hazard information led to the conclusion that NCH, although a corrosive mixture, can be safely transported and treated at the DuPont SET facility. Additionally, the toxicity testing, exposure information, predictive modeling and literature searches support the conclusion that MPA and EMPA present a low risk of toxicity to humans.

Overall Conclusion of DuPont Technical Assessment on U.S. Army Newport (Indiana) Project

The four assessments, which were reviewed by several independent scientists including the Virginia Institute of Marine Sciences, Virginia Polytechnic Institute and the U.S. Centers for Disease Control and Prevention – conclude that the wastewater from the U.S. Army's Newport, Indiana site can be safely transported, managed as a corrosive material, effectively treated at the DuPont SET facility and disposed of under permits with both U.S. EPA and the New Jersey Department of Environmental Protection without adverse impact on the environment.

TREATABILITY OF NEWPORT (INDIANA) CAUSTIC HYDROLYSATE

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BOD - biochemical oxygen demand

BOD_5 - five-day biochemical oxygen demand

CFR – Code of Federal Regulations

COD - chemical oxygen demand

DCCDI or DCC - dicyclohexyl carbodiimide, used to stabilize the original chemical agent

DICDI or DIC - diisopropyl carbodiimide, used to stabilize the original chemical agent

DOC - dissolved organic carbon

DOT – U.S. Department of Transportation

EMPA - ethyl acid

Fe – iron

gpd - gallons per day

MGD – million gallons per day

MLSS - mixed liquor suspended solids

MLVSS - mixed liquor volatile suspended solids

MPA - acid

NCH – Newport (Indiana) Caustic Hydrolysate generated from destruction of chemical agent

NECDF – Newport (Indiana) Chemical Weapons Destruction Facility (NECDF)

NH_3-N – ammonia and ammonium expressed as nitrogen

NJPDES – New Jersey Pollutant Discharge Elimination System (wastewater discharge permitting program)

NO_2-N – nitrite expressed as nitrogen

NO_3-N – nitrate expressed as nitrogen

OUR - oxygen uptake rate

P – phosphorus

PBT – Persistent and bioaccumulative toxic pollutant

PO_4-P – orthosphosphate expressed as phosphorus

S - Sulfur

SET - DuPont Secure Environmental Treatment business

SVI - sludge volume index

TDS - total dissolved solids

TN – total nitrogen (the sum of NO_2-N + NO_3-N + organic nitrogen + NH_3-N)

TOC - total organic carbon

TS - total solids

TSS - total suspended solids

VSS - volatile suspended solids

WET – whole effluent toxicity (96-hour acute Fathead minnow test)

WWTP - Wastewater Treatment Plant

EXECUTIVE SUMMARY

The objective of this study was to determine if the Wastewater Treatment Plant (WWTP) at the DuPont Secure Environmental Treatment (SET) facility at Chambers Works (Deepwater, NJ) could effectively treat Newport Caustic Hydrolysate (NCH) at the anticipated generation rate. The production rate of 8%-16% NCH[1] is anticipated to be 3000 to 7000 gallons per day.

In this study, there were three general criteria for the effective treatment of NCH:

1. Ability to maintain satisfactory control of wastewater and sludge odors
2. Ability to maintain control of SET WWTP operations (*e.g.,* effective dissolved organic carbon [DOC] removal, manageable foaming, pH control, solids management)
3. Ability to assure permit compliance - Critical permit parameters that were considered in this study included effluent biochemical oxygen demand (BOD_5), percent BOD_5 removal and Whole Effluent Toxicity (WET). Total suspended solids (TSS) and ammonia limits were also taken into account.

Prior to treatment in the SET biological treatment system, a pretreatment process – most likely chemical oxidation – was anticipated to be required. Several such processes were identified in a brainstorming session conducted by Shaw Environmental & Infrastructure with representatives of DuPont and the Army. This list was narrowed to three processes as the focus of the treatability study: hydrogen peroxide addition, Oxone® addition and Fenton chemistry. Batch treatment studies were conducted to screen for appropriate dosages and operating conditions based primarily on effectiveness of odor reduction and process safety.

The WWTP, operated by DuPont SET, utilizes two stages of the patented PACT® process (Powdered Activated Carbon Treatment with activated sludge). A biotreatability study was conducted using continuously fed 5 L Eckenfelder-type PACT® bioreactors. The bioreactors were seeded with activated sludge samples obtained from the WWTP secondary aerators. Pretreated NCH samples were combined with wastewater samples

[1] The term 8%-16% NCH refers to 8-16 weight% formulation NCH; *i.e.*, an 8-16% mass loading of agent in the reaction mass into the destruction reactors at the Newport (Indiana) Chemical Weapons Destruction Facility (NECDF)

obtained periodically at the influent to the WWTP secondary biotreatment system. The bioreactors were operated to simulate the conditions at the WWTP using actual wastewater and activated sludge under plant process conditions.

During the treatability study, ten bioreactors were operated in parallel (see Figure 4, in the body of the report, for descriptions). In addition to a control reactor fed plant site wastewater only, there were nine reactors fed with pretreated NCH. Pretreatments included pH adjustment only; and pH adjustment and peroxide, Oxone® or Fenton reactants. The NCH in one of the peroxide treated and one of the Fenton treated reactors also received steam stripping. Steam stripping was included in the study because initially there was concern that the NCH would meet the definition of a hazardous waste under the Resource Conservation and Recovery Act (RCRA) due to a total organic carbon (TOC) concentration exceeding 10%. Under RCRA this would list it as a D001 waste that would require steam stripping. However, 8-16% NCH will not exceed 10% TOC and so steam stripping will not be required.

Peroxide pretreated NCH was fed at three different rates: the base loading, four times that loading and a slower acclimation system. Later in the study, the slower acclimation system was eventually brought up to twice the base loading. The original agent had been stabilized with either of two compounds: dicyclohexyl carbodiimide (DCCDI or DCC) or diisopropyl carbodiimide (DICDI or DIC). Although neither of these compounds was found in the samples after the hydrolysis process, both types of hydrolysate samples were tested in this study. The DCC hydrolysate was the focus of the study due to the availability of greater volumes of these samples through most of the program period.

For most of the program, the NCH available for study was hydrolysate that had been reprocessed from 33% NCH to generate 16% NCH. In the final three weeks of the biotreatability study, actual 8% and 16% NCH that became available was used in some of the bioreactors to assure that it performed similarly to the reprocessed NCH.

Several wastewater parameters were monitored routinely in the influent and effluent to each bioreactor including dissolved organic carbon (DOC), biochemical oxygen demand (BOD), chemical oxygen demand (COD), ethyl acid (EMPA), methylphosphonic acid (MPA), and other parameters. Thiolamine was only monitored in the effluent for the reactor receiving pH-adjusted NCH with no other pretreatment, since the pretreatment oxidation completely destroyed the thiolamine. Reactor conditions such as pH, temperature and mixed liquor suspended solids (MLSS) were monitored and controlled at levels similar to those maintained in the full-scale SET WWTP.

The following summarizes the results and main observations:

- Pretreatment studies showed that given the proper dosages, any of the three oxidants provide substantial odor reduction.
- The pretreatment oxidation achieved greater than 99.9% destruction of thiolamine, the main sulfur-containing component of the NCH. Analyses indicated that the thiolamine reacted rapidly and completely with the various oxidant chemicals. None of the oxidants substantially affected the overall concentration of the methylphosphonic acid species, although there was some conversion of EMPA to MPA in some cases.
- Steam stripping had no noticeable impact on the composition or biotreatability of the peroxide-pretreated or Fenton-pretreated NCH.
- BOD_5 removals were good during all phases of testing for all reactors ($\geq$90%) and effluent BOD_5 concentrations were well below the WWTP permit limit despite the fact that the study employed only one stage of PACT® treatment while the WWTP employs two stages. There was no statistically significant difference in effluent BOD_5 concentrations or removals among any of the reactors, including the control unit.
- Effluent DOC concentrations for the test bioreactors averaged somewhat higher than the control effluent, although less so than the increase in influent DOC. The reactor loaded at an equivalent of 4 times the base rate of NCH (*i.e.*, 20,000 gpd of 16% NCH) had notably higher influent and effluent DOC concentrations than any of the other reactors. Despite the higher effluent DOC concentrations in the NCH reactor effluents, whole effluent toxicity results for the test reactor effluents achieved the LC50 permit limit and were statistically equivalent to the control, with the possible exception of the reactor loaded at 4 times the base rate of NCH. No significant operational issues were encountered for any of the reactors with respect to such aspects as foaming, solids management, sludge cake formation, *etc*.
- Odor intensity results for the test bioreactor contents were statistically indistinguishable from the results for the control bioreactor. Similarly the odor intensity results for the test bioreactor sludge cakes were indistinguishable from the control.

CONCLUSIONS

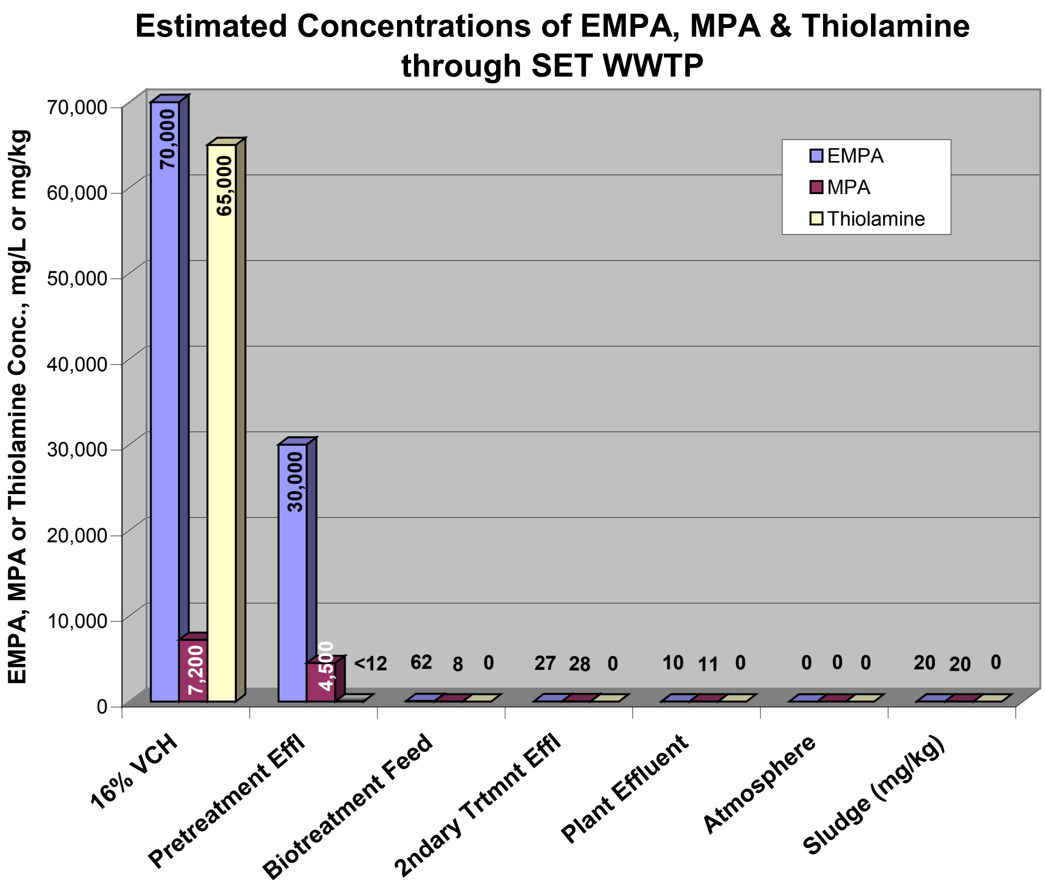
Based on the success criteria of this treatability study, the DuPont WWTP can effectively treat the stated volume (3000 to 7000 gpd) of hydrolysate generated at the Newport site. The treatability study was designed to simulate the operation of the full-scale SET WWTP accurately, albeit conservatively. DuPont has an excellent record of implementation based on this scale of study both within the SET WWTP and company-wide. No additional testing is necessary to verify the conclusions, although work is continuing in order to develop Basic Data for specific design details and optimization.

- The caustic NCH, as received, was observed to be odorous, but no more so than some materials routinely handled at the SET WWTP. Any of the three chemical oxidation pretreatment methods tested – hydrogen peroxide, Oxone® and Fenton chemistry – was shown to destroy the odor causing thiolamine, when applied at the appropriate concentration. Therefore, pretreatment will enable NCH odors to be controlled in the SET WWTP.
- Hydrogen peroxide was determined to be the preferred pretreatment chemical from the standpoint of effectiveness and process safety management.
- Steam stripping will not be required under RCRA for 8-16% NCH and it provides no benefit in treatability of the hydrolysate.
- The bioreactor study demonstrated treatment at an equivalent feed rate of 5000 gpd 16% NCH with all three oxidation protocols. Hydrolysate at lower concentrations could be fed at proportionately higher rates; e.g., 8% NCH could be fed at double the rate shown for 16% NCH. No statistical differences in performance were noted for reactors fed with pretreated NCH regardless of the stabilizer (DCC or DIC) used for the original agent. At the conclusion of the study, the bioreactor system was operating within normal operating conditions at an equivalent NCH (16%) feed rate of 10,000 gallons per day with the preferred pretreatment method (hydrogen peroxide oxidation). Feed rates above 10,000 gpd may be possible, but would have to be evaluated in a carefully controlled plant trial.
- Chemical oxidation pretreatment will reduce the thiolamine content of the NCH below detection, but has limited effect on the EMPA and MPA. Biotreatment will convert a substantial fraction of EMPA to MPA. Concentrations of EMPA and MPA will be reduced to a total of approximately 27 and 28 mg/L, respectively, through the SET WWTP and 10 and 11 mg/L, respectively, in the plant effluent at the base loading rate (see Figure 1 at an estimate of the fate of EMPA, MPA and thiolamine treatment system). No other organic components or degradation products of the NCH that were identified in GC-MS scans of the raw or pretreated NCH were found in the

bioreactor effluent. A related study on the environmental effects of EMPA and MPA will be issued at about the same time as this treatability study report. The report, entitled "Screening Level Ecological Risk Assessment for Discharge of Effluent from the Treatment of Newport (Indiana) Caustic Hydrolysate" (Hoke, *et al.*, 2004), shows that the levels of EMPA and MPA described above will have no aquatic toxicological impact. For example, the chronic risk characterization for MPA was based on chronic No Observable Effect Concentration (NOEC) values from the studies using *Ceriodaphnia dubia* (a sensitive freshwater invertebrate), *Americamysis bahia* (mysid shrimp, a sensitive marine invertebrate), *and Cyprinodon variegates* (sheepshead minnow, a sensitive marine vertebrate). These NOEC values range from 87 mg/L for *Ceriodaphnia* to 500 mg/L for mysid shrimp and over 1,000 mg/L for sheepshead minnow, compared with EMPA and MPA concentrations each below 1 mg/L, after mixing in the receiving stream.

The foregoing results and observations achieved the three major success criteria of the study—odor control, operational stability and permit compliance. All three aspects were demonstrated conclusively through this study.

Figure 1[2]



[2] Based on the following assumptions:
- 7000 gpd of 16% NCH
- Pretreatment chemicals added in 1:1 volume ratio to NCH
- WWTP flow of 10 million gpd and outfall flow of 26 million gpd – the lowest monthly flows experienced in 2003 – for conservatism.
- Sludge at 27% solids concentration

I. Background

A. Study Objectives

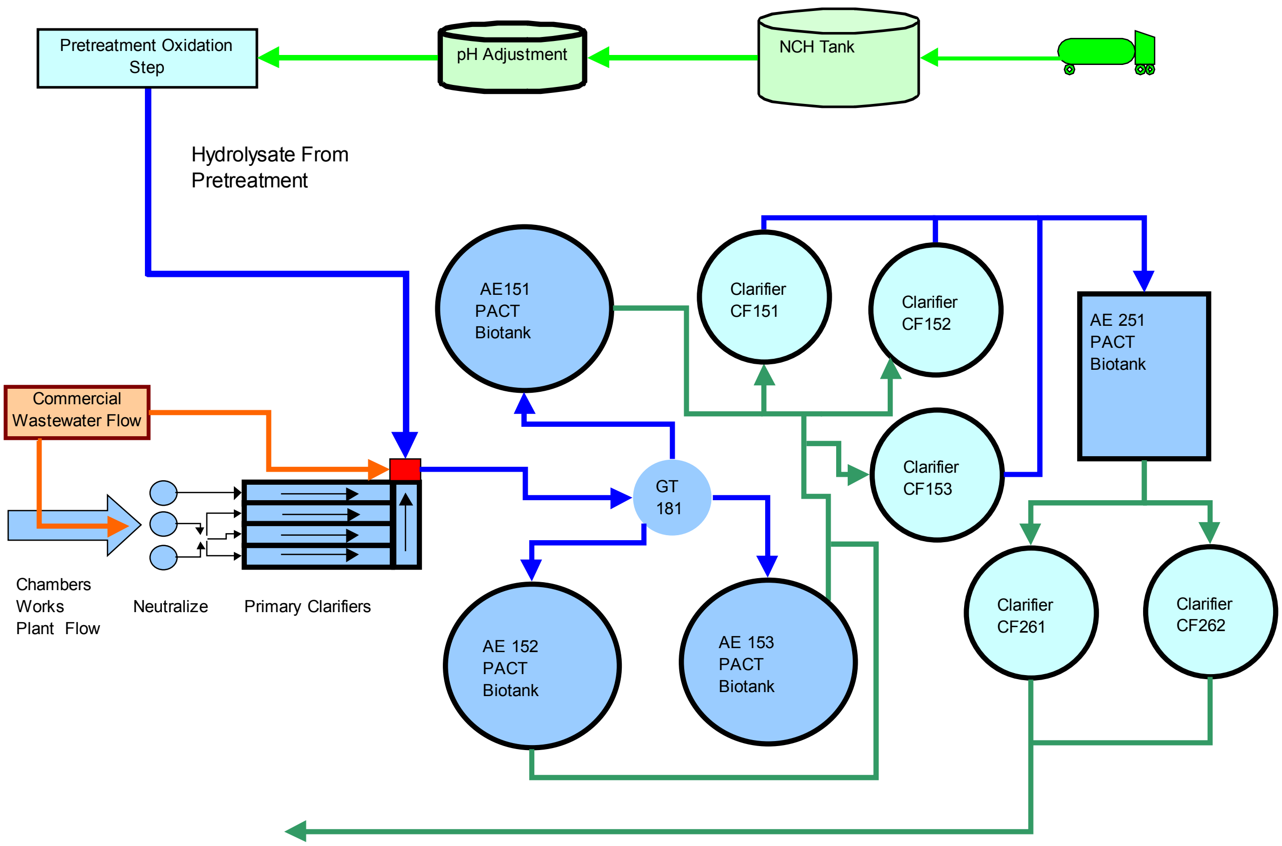
The objectives of the study were to determine if the Wastewater Treatment Plant (WWTP) at the DuPont Secure Environmental Treatment (SET) facility at Chambers Works (Deepwater, NJ) can successfully treat Newport (Indiana) Caustic Hydrolysate (NCH) and, if so, to determine the maximum acceptable rate. The total production of NCH is anticipated to be approximately two million gallons in one year of nominally 16 weight% formulation NCH ("16% NCH") at about 7 wt% Total Organic Carbon (TOC) concentration, which translates to about 5000 gpd (about 1 tank truck per day). This rate was set as a nominal minimum goal loading rate for this study, although lower rates also could be accommodated in the WWTP. Lower concentration NCH may also be produced, depending on the amount of caustic used in the hydrolysis reaction. If so, then the volume basis will be altered to maintain equivalent mass loading. Samples of both 16% and 8% NCH were tested in this study.

B. SET Wastewater Treatment Plant

The SET WWTP is an advanced industrial wastewater treatment facility that currently handles 10-15 MGD of wastewater from the manufacturing operations at the DuPont site at Chambers Works, as well as wastewater received from off-site. The range of flow rates mentioned represents the minimum and maximum monthly averages handled at the WWTP in 2003. The plant was designed for and has demonstrated the capability to handle well over 30 MGD. The WWTP also has demonstrated the flexibility to handle flow rates below 10 MGD. Operations in the WWTP include a variety of pretreatment technologies, lime neutralization, primary clarification, two-stages of PACT®[3] (biotreatment combined with powdered activated carbon) with clarification in each stage (see Figure 2; note that the figure contains a preliminary depiction of operations to receive, pretreat and biotreat NCH).

[3] PACT® is a unique activated sludge technology enhanced by addition of powdered activated carbon. The PACT® process was patented by DuPont. PACT® is a registered trademark of USFilter/Zimpro Products.

Figure 2.
Diagram of DuPont SET Wastewater Treatment Plant



As noted above, the monthly average flow rate at the SET WWTP typically ranges between 10 and 15 MGD. For purposes of evaluating issues involving concentrations of compounds of interest related to NCH in the wastewater, the minimum monthly average flow rate of 10 MGD is used throughout this report. This is a conservative approach, although not excessively so. For example, if an NCH component concentration were 50 mg/L in the wastewater at the minimum flow of 10 MGD, then it would be at 33 mg/L at the maximum flow of 15 MGD. The nominal base feed rate of 16% NCH is described above as 5000 gpd.

When compared with the WWTP flow of 10 MGD, this yields a flow ratio of 16% NCH:WWTP of 1:2000. At the maximum generation rate of 7000 gpd NCH, the NCH:WWTP flow ratio is 1:1430. In the study, other NCH flow rates were considered, as well:

Loading Case	NCH Flow (gpd)	NCH:WWTP flow ratio
Base Case	5,000	1:2,000
Maximum Generation	7,000	1:1,430
¼ x Base Case	1,250	1:8,000
½ x Base Case	2,500	1:4,000
2 x Base Case	10,000	1:1,000
4 x Base Case	20,000	1:500

C. Criteria for Success

There are three general criteria for the successful treatment of NCH:

(1) Ability to maintain satisfactory control of wastewater and sludge odors

(2) Ability to maintain control of SET WWTP operations (e.g., effective dissolved organic carbon [DOC] removal, manageable foaming, pH control, solids management, etc.)

(3) Ability to assure permit compliance

BOD, DOC, and COD removal were determined along with several other standard wastewater parameters. Detailed discussion of criteria for success is provided in the section on Experimental Design.

In addition to overall treatability, methods were developed to monitor the fate in the WWTP of EMPA, MPA and thiolamine. The study determined the percent removal of these constituents, and estimated their fate in terms of partitioning to air, solids and water.

It was not be possible to quantitatively analyze for every compound that might be present in NCH. However, aquatic toxicity testing was performed to determine the potential impact of residual amounts of NCH compounds in the effluent.

D. Pretreatment Alternatives

The options for pretreatment were determined in a brainstorming session facilitated by Shaw Environmental, Inc., on July 24, 2003. Participants included representatives of Shaw, DuPont and the U.S. Army.[4]

At elevated concentrations (above about 25%) NCH is defined under the Resource Conservation and Recovery Act (RCRA) to be a Characteristic D001 flammable, high TOC (*i.e.*, >10% TOC) hazardous waste. The goal of pretreatment is to be able to comply with regulations for a high DOC, D001 waste, and to prepare the stream for biotreatment. If the NCH were defined as a D001 waste, then steam stripping would be necessary unless a regulatory variance were obtained. Therefore, steam stripping was included among the pretreatments evaluated in this study. As the study progressed it became apparent that the NCH received (8-16% NCH) would contain less than 10% TOC, so that stripping would not be a regulatory requirement, and furthermore would offer no ancillary advantages in the pretreatment process.

Since NCH is odorous, deodorization was assumed to be a required pretreatment step. Therefore, hydrogen peroxide and Oxone® addition were evaluated as the deodorization technologies.

One aspect of interest was whether it would be possible to chemically pretreat to remove EMPA/MPA or to enhance their biotreatability. Therefore, advanced oxidation pretreatment with Fenton's Reagent was evaluated.

As mentioned above, biotreatment will be the ultimate treatment process for this material. Based on the foregoing discussion, the following alternative treatment methods were evaluated:

(1) pH adjustment (to create a single phase), deodorization, steam stripping, PACT® biotreatment
(2) pH adjustment and deodorization in one unit operation, steam stripping, PACT® biotreatment
(3) Fenton's Reagent (to achieve pH adjustment, deodorization and advanced oxidation), solids separation, steam stripping, PACT® biotreatment
(4) – (6) As above, without steam stripping

[4] Shaw Environmental, Inc., *Meeting Minutes – DuPont VX/Caustic Hydrolysate Treatability Study Technical Brainstorming Session*, 24 July 2003.

In addition the study considered the possibility of pretreatment *via* pH adjustment only (*i.e.,* "acidification" only) prior to biotreatment.

E. Biotreatability Studies

There were two general questions to be answered from the biotreatability studies:

(1) Can the effluent from pre-treatment be processed in the WWTP without odor problems and without permit compliance problems?

(2) What is the fate of the EMPA, MPA and thiolamine?

To answer these questions, a study was conducted utilizing continuous flow Eckenfelder-type reactors operated in parallel. Each reactor was fed pre-treated effluent mixed with a representative sample of wastewater obtained from the SET WWTP. Effluent was added at a base loading rate to most reactors, but two reactors were loaded with lower and higher initial loading rates, respectively, to determine the impact of loading rate on the ability of the biomass to acclimate.

Analytical methods for EMPA and MPA were developed by DuPont early in the study and DuPont was able to use them for analysis of the NCH. DuPont was able to modify the MPA protocol to enable analyses of the biotreatability influents and effluents, but EMPA content of these samples could only be estimated by difference[5] due to matrix interferences in the background wastewater. An analytical method for thiolamine was provided to DuPont by Shaw near the end of the study, so limited results are available in this report. Sludge analysis was not found to be possible using these methods, due to lack of development of a suitable extraction step, so estimates are provided by mass balance utilizing physical properties estimates (see Appendix L).

F. Reprocessed *vs.* Actual ("Fresh") Hydrolysate

The bulk of the study was conducted using NCH that had been processed at nominally 33% agent loading and then reprocessed in the laboratory to represent a lower loading (nominally 16%) prior to receipt by DuPont. Towards the end of the study, freshly processed hydrolysate samples at nominally 8% and 16% loadings were provided. Tests were conducted to confirm that this new material behaved similarly to the reprocessed material used in the majority of the study

[5] EMPA was determined by measuring total phosphonate and subtracting the measured MPA and orthophosphate values.

and was compatible with the pretreatment and biotreatment processes determined in the other phases of study.

G. Suitability of Laboratory-Scale Testing to Demonstrate Treatability at SET

The treatability study was conducted in various laboratory-scale operations, including beaker-sized oxidation reactors and five-liter bioreactors. DuPont has demonstrated the suitability of this scale of testing for waste acceptance feasibility testing in relation to the SET WWTP. With respect to pretreatment testing, a hydrogen peroxide oxidation process already has been designed and installed based on similar scale data and is currently in operation. With respect to PACT® bioreactor testing, laboratory-scale reactors have been used in DuPont to design several of its wastewater treatment systems currently in operation. Moreover, the SET WWTP has a long history of using "minilabs", bench-scale PACT® reactors, to screen wastewaters for acceptance.

II. METHODS

A. Wastewater Characterizations

Initial samples received of NCH and from the SET WWTP were characterized for the following conventional wastewater parameters:

> **Soluble (*i.e.*, filtered) and total COD, TOC or DOC, soluble BOD_5, NO_2-N, NO_3-N, TN, NH_3-N, total P, PO_4-P, total S, TSS, VSS, TS, TDS, pH. (See List of Abbreviations on page 4.)**

NO_2-N and NO_3-N concentrations were found to be low in the first samples of DCC and DIC NCH and so these analyses were not performed on subsequent samples. TS and TDS were no longer performed either because the high organic content did not allow drying. Conductivity was substituted for TDS in subsequent samples.

All conventional parameter analyses were performed in accordance with Standard Methods for the Examination of Water and Wastewater, 20th Edition (AWWA, APHA, WEF, 1998).

Samples of NCH were also characterized for EMPA, MPA, and thiolamine. These analyses were performed on the SET wastewater, as well, to determine whether there were matrix interferences. Where such interferences were present, attempts were made to modify the methods to reduce such interferences. Matrix interferences in the SET wastewater resulted in false positive values for EMPA that could not be overcome. Therefore, EMPA concentrations in influent and effluent wastewater samples were estimated by measuring total phosphonate concentration and subtracting the MPA and phosphate concentrations determined for the appropriate samples. Appendix D provides the methods for EMPA and MPA used for the NCH, as well as calibration and QA/QC information. Appendix E provides similar information for thiolamine analysis used for the NCH and the wastewater samples. Appendix F provides a description of the method used for phosphonate analysis.

The NCH samples were also subject to testing for flammability and combustibility as defined by the U.S. Department of Transportation (DOT) regulations:

- Flammable Liquid:
  - CFR 173.120(a) —"A flammable liquid (Class 3) means a liquid having a flash point of not more than 60.5°C (141°F)."

- Combustible Liquids:
  - 49 CFR 173.120(b)(1) – "For the purpose of this subchapter, a combustible liquid means any liquid that does not meet the definition of any other hazard class specified in this subchapter and has a flash point above 60.5°C (141°F) and below 93°C (200°F)."

B. Pretreatment Investigations

Four categories of pretreatment were investigated for NCH: pH adjustment, deodorization, advanced oxidation using Fenton's Reagent, and steam stripping.

Samples of NCH, each containing one of two different stabilizers (DCCDI or DICDI), were tested. The NCH containing the DCCDI was subjected to a full battery of pretreatment tests. Due to the limited volume available, the NCH containing DICDI was subjected to a partial, but representative number of pretreatment tests, including pH adjustment, deodorization with one of the chemical reagents (peroxide) and Fenton's reagent.

pH adjustment

The NCH exhibits a high pH due to the use of caustic in the hydrolysis process. Therefore, for the full-scale, pH adjustment with a strong acid, such as sulfuric acid, will be needed to assure compatibility with biotreatment. Titration curves with sulfuric acid were developed for the NCH samples.

Deodorization

The NCH is considered highly odorous. It is believed that this is primarily due to the presence of a high concentration of thiolamine. Therefore, it was anticipated that effective deodorization can be achieved by chemical oxidation with hydrogen peroxide (H_2O_2) or Oxone®. Bench-scale tests were performed to determine the appropriate oxidant dosage and reaction time. Odor reduction was judged qualitatively in these tests. Quantitative confirmation was performed by an odor panel for a small number of pretreatment recipes. See the discussion of Odor Evaluations near the end of the Biotreatability Study section, below.

Hydrogen Peroxide Pretreatment: It is known that organic sulfur reacts with hydrogen peroxide to reduce odors. Also, previous work by DuPont, including an extensive process hazards review, on H_2O_2 pretreatment of high pH streams at the SET WWTP determined that using 10 wt% hydrogen peroxide was safe for commercial operation. Therefore, the pretreatment strategy was to use 10 wt% H_2O_2 at a dosing rate proportional to the total sulfur content of the sample. For these tests the sulfur content was estimated based on the stoichiometric amount of sulfur in the NCH. For 16% NCH, the stoichiometric amount of sulfur is 1.9% or 19,000 ppm (1 mole of S at molecular weight of 32 gm/mole per mole of agent at molecular weight of 267 gm/mole).

Oxone® Pretreatment: Oxone® is the trade name for the triple salt ($2KHSO_5$ * $KHSO_4$ * K_2SO_4). Oxone® contains approximately 43 wt% potassium peroxymonosulfate, which contains active oxygen. The solubility of Oxone® is about 25 wt% at 20 C. One pound of hydrogen peroxide contains approximately as much active oxygen as 10 lbs of Oxone®. The pretreatment strategy for Oxone® was to use approximately the same amount of active oxygen as was used for hydrogen peroxide pretreatment.

Fenton's Reagent

Fenton's Reagent is a common advanced oxidation process. The term "advanced oxidation" refers to oxidation processes that are catalyzed in such a way as to form free radicals that often have strong oxidizing capabilities. Fenton's chemistry is implemented by reducing pH well below neutral (*e.g.*, with sulfuric acid), adding hydrogen peroxide and adding a source of ferrous iron (*e.g.*, ferrous sulfate).

Fenton Chemistry is most often associated with remediation of relatively low concentrations of organics in groundwater or wastewater – TOC typically on the order of tens to perhaps hundreds of mg/L. The NCH primarily tested in this study had a TOC of about 7 wt%; that is, about 70,000 mg/L – two to four orders of magnitude greater than typical Fenton applications.

Typical practice is to ratio the H_2O_2 dose to the organic (TOC) levels and to ratio the iron dose to the H_2O_2. However, this waste is so atypical for Fenton application that typical ratios are likely not appropriate. Initial scouting work by Parsons and by DuPont (in the initial days of this study) gave undesirable—in fact, unmanageable—results, including boil-over, and jelly-like material.

Limited work by DuPont in the early 1990s on wastewaters in the 500-2000 mg/L TOC range, unrelated to NCH, showed that iron doses well under 100 mg/L were optimal regardless of the TOC levels, while peroxide needed to be dosed at levels relative to the TOC. This was a key difference from the initial scouting work performed by Parsons[6] and by DuPont on NCH.

Other considerations based on DuPont's 1990s findings:

- Multi-stage Fenton application was more effective than a single dosage, particularly where high TOC was involved.
- The impact or effectiveness of the iron appeared to diminish substantially over time such that time of mixing of the iron dose was recommended to be limited to 5 minutes.

[6] "An Evaluation of Pre-Treatment of VX Hydrolysate For Disposition at Non-Incineration Based Treatment/Storage and Disposal Facilities (TSDFs)", prepared under Contract DAAA 09-99-C-0016, CLIN 1700, Draft, April 2002.

- Optimal pH appeared to be between 2.5 and 4.0 for the Fenton reaction. (Note that pilot work by DuPont on groundwater has shown the need to maintain pH towards the lower end of that range to avoid fouling equipment with iron precipitates.)

In addition, it was hypothesized that elevated temperature could help to destroy the phosphonate bond in the EMPA and MPA, so this condition was investigated.

Overview of Approach

- Fenton's reagent was added gradually in increments over a period of time

- Because of potential ineffectiveness of iron left in the process longer than 5 minutes, the tests were conducted in a manner that renewed the iron dose, as well as incrementing the peroxide dose

- pH was maintained around 3.0

- A maximum cumulative peroxide dose was tested initially; odor results were judged qualitatively by the individual performing the testing; and TOC, MPA and EMPA were analyzed unless there was an obvious physical problem with the sample (e.g., boil-over or creation of an unmanageable material). If there were a physical issue, then the peroxide dose was to be reduced substantially in another test.

In addition to room temperature dosing, elevated temperature (70^{o}-$90^{o}C$) testing was scouted to determine whether it provided any benefit to the effectiveness of Fenton's reagent.

Steam Stripping

As the pH adjusted and deodorized NCH would comprise a small proportion of the total feed to the SET steam stripper, the objective of tests on NCH was simply to determine the general level of organics removal that would be achieved on a NCH-only basis. Batch distillation was employed to simulate steam stripping. This distillation was carried out on aliquots of NCH that had been pretreated by pH adjustment and peroxide addition or Fenton's reaction. Following steam stripping of the pH adjusted and deodorized NCH samples, the simulated bottoms and overheads were characterized for DOC and COD.

Pretreatment Test Set-up

Initially experiments on pH adjustment, deodorization, and Fenton treatment were planned to be conducted in a jacketed glass vessel (round bottom flask or resin kettle, a.k.a. "reactor") with a nitrogen sweep with off-gases controlled through a carbon canister. This experimental set-up proved to be cumbersome. When it was found that the odor level of the NCH samples could be controlled satisfactorily by venting through a laboratory hood, the reactor was simplified to an open, stirred container.

pH adjustment was performed by manually adding a concentrated sulfuric acid solution (*e.g.*, 20-93 wt% H_2SO_4) while mixing and observing the pH. For deodorization, hydrogen peroxide was added at a concentration of approximately 10 wt%. The amount of H_2O_2 added was based on the total amount of reduced sulfur contained in the NCH sample, calculated as 19,000 ppm in 16% NCH. Various mole ratios of H_2O_2 to sulfur were investigated to determine the amount required to achieve acceptable deodorization and/or pH adjustment prior to biotreatment. A range from one to three moles of H_2O_2 per mole of sulfur was tested in initial screening. However, odor observations and residual peroxide analysis dictated that substantially lower dosages be tested, as well.

As with peroxide, Oxone® addition was based on the sulfur content of the NCH. As explained above, Oxone® was tested at doses based on its equivalent oxygen content as compared with hydrogen peroxide.

The testing procedure for Fenton's reagent was more complicated than for peroxide and Oxone®. The baseline test procedure is summarized in the following steps:

1. Save aliquot of NCH for TOC, EMPA and MPA analysis
2. Prepare FeSO4 stock solution at 2.5 gm Fe/L (=2.5 mg/mL)
3. Prepare 10 wt% H_2O_2 stock solution
4. Prepare 1:1 H_2SO_4 stock solution (1 part water, 1 part 93 wt% H_2SO_4 v:v)
5. Prepare 1:1 NaOH stock solution (1 part water, 1 part 50 wt% NaOH v:v)
6. Measure 25 mL NCH into vessel with 100 mL capacity.

7. Reduce pH of NCH to 3.0 +/- 0.5 using stock H_2SO_4. Mix by gentle shaking.

8. Insert magnetic stirrer. After pH adjustment is complete, maintain vigorous stirring throughout the procedure

9. Add 0.2 mL FeSO4 stock solution. (This was 20 mg/L Fe *vs.* original NCH volume.) Allow to mix for 5 minutes

10. Add 2.5 mL 10 wt% H_2O_2. Allow to mix for 10 minutes.

11. Repeat steps 9 & 10 nine more times. (This gave 200 mg/L Fe and 10 wt% H_2O_2 *vs.* original NCH volume or 100 mg/L Fe and 5 wt% H_2O_2 *vs.* final 1:1 NCH: H_2O_2.)

12. Make visual observations after each step. Measure temperature and pH if possible.

13. Split sample. Save half for TOC, EMPA and MPA analysis.

14. Adjust pH of remainder to 7.0 +/- 1.0 with NaOH stock solution. Analyze filtered TOC.

Alternative peroxide doses were tested, as well, and an elevated temperature test at 70^{o}-90^{o}C was also conducted.

Steam stripping simulations were conducted in a batch distillation setup, which consisted of a round bottom flask heated with a heating mantle, overhead mixer, distilling head, condenser, and a distillate collection flask. A nitrogen blanket was used to assure that the atmosphere in the test system was inert. The distillation was conducted at atmospheric pressure. The NCH sample was pH adjusted to 9.0 using 6.0 M NaOH prior to distillation. The distillation was considered completed when the pot temperature reached 100^{o}C, or when approximately 15 volume% of the sample was distilled overhead. In these distillations, no overheads were collected up to 100^{o}C, so temperature was brought up to 104^{o}C and a 15 gms overhead sample was collected for each run.

C. Biotreatability Study

Type and Source of Seed

Seed biomass from the SET WWTP was used for seeding the continuous flow reactors. The seed was characterized for pH, mixed liquor suspended and volatile suspended solids (MLSS and MLVSS).

Reactor Set-up

The approach taken in the biotreatability studies was to accurately simulate the first stage of the SET WWTP's two-stage PACT® system. The treatability studies were a conservative test to ensure that the NCH could be treated in the SET WWTP. Additional treatment and polishing could be anticipated at full scale with a second stage of PACT® in the WWTP's tertiary system.

Five-liter "Eckenfelder" reactors, which have clarifiers integral with the aerated reactors, separated by a baffle, were set up in parallel. Figure 3 is a photograph of one of the reactor systems. Ten reactors were operated during the period from October 24 to December 15, 2003, as follows:

1. Control

2. pH adjusted, deodorized (with peroxide) and steam stripped—base concentration of NCH with DCCDI stabilizer[7]

3. pH adjusted, deodorized (with peroxide) without steam stripping—base concentration of NCH with DCCDI stabilizer[5]

4. same as #3 except at four times (4X) the base NCH concentration

5. same as #3 except with very slow acclimation (explained later)

6. pH adjusted and deodorized (with Oxone®) without steam stripping—base concentration of NCH with DCCDI stabilizer[5]

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[7] NCH samples were generated from material originally containing either of two different stabilizers: dicyclohexyl carbodiimide (DCCDI) and diisopropyl carbodiimide (DICDI). The stabilizer for which the greater sample volume is available, DCCDI, was tested in all reactors except the control (no NCH) and reactor #9 (NCH with DICDI). There was insufficient volume to run the full battery of bioreactor tests on the NCH with DICDI.

7. Fenton's Reagent and steam stripped – base concentration of NCH with DCCDI stabilizer[5]

8. Fenton's Reagent without steam stripping – base concentration of NCH with DCCDI stabilizer[5]

9. pH adjusted and deodorized (separately or combined) without steam stripping – base concentration of NCH with DICDI stabilizer[5]

10. pH adjusted only – base concentration of NCH with DCCDI stabilizer[5]

Figure 3.
Photo of Control Reactor System

Figure 4 provides a summary of the reactor feed conditions described above.

The control reactor received only the SET WWTP wastewater. Feeds for the test reactor contained the control feed spiked with appropriate quantities of the NCH pretreated as shown in the descriptions in the list, above. The "base concentration" refers to a dilution of 1:2000 of 16% NCH in the control feed, and "4X base concentration" implies a dilution of 1:500. However, the actual volumetric dilution depended on the volume that results after the pretreatment step. For example, addition of sulfuric acid and hydrogen peroxide in the pH adjustment and deodorization steps, respectively, added volume to the NCH sample. Thus, the sample contribution to the test reactor feeds were proportionately greater. Further, the feed proportions noted above refer to 16%

NCH equivalent basis at approximately 7 wt% TOC. Lower concentration NCH (nominally 8%) was also tested towards the end of this study, so double the sample volumes were applied, yielding lower dilutions to obtain the same base concentration.

Figure 4.
Test Bioreactor Feed Conditions*

Rctr #		ID	pH	Deodorizing Chem				NCH Feed Rate			Stabilizer	
Orig	Rev	Code	Neutralized	H_2O_2	Oxone®	Fenton	Strip	Base	4X	Slow	DCCDI	DICDI
1	1	Control										
2	2	NPSBC	X	X			X	X			X	
3	3	NPBC	X	X				X			X	
4	9	NP4xC	X	X					X		X	
5	4	NPLC	X	X						X	X	
6	5	NABC	X		X			X			X	
7	6	FSBC				X	X	X			X	
8	7	FBC				X		X			X	
9	8	NPBI	X	X				X				X
10	10	NBC	X					X			X	

Key to abbreviations:
- N Neutralized (pH reduced) with sulfuric acid
- P Preferred oxidant (Peroxide treated)
- A Alternate oxidant (Oxone® treated)
- F Fenton treated
- S Steam stripped
- B Base loading case (1 truck/day of 16% NCH)
- L Low loading case (slow acclimation with gradual loading of NCH)
- 4x 4x loading case (4 trucks/day of 16% NCH)
- C NCH with DCC stabilizer
- I NCH with DIC stabilizer

* The column designated as "Original Reactor #" refers to the list shown on the previous page. The "Revised Reactor #" refers to the number designated in the laboratory to simplify technician operations. The revised reactor numbers are used in the remainder of this report.

Goals for operational parameters for the aerobic reactors were set as shown in Table 1 with the objective of simulating the first stage PACT® reactors at SET.

Table 1.
Operational Conditions for the Reactors

Parameter	REACTOR CONDITION
Hydraulic Retention Time (HRT)	29 hours[8]
Reactor size	5 L
Influent flow rate	4.2 L/day (2.9 mL/min)
Powdered Activated Carbon (PAC) addition (feed flow based)	50 mg/L based on influent flow (*i.e.*, 50 mg PAC/L flow)
Mixed liquor suspended solids (MLSS)	10,000 mg/L based on reactor volume
Temperature	25°C
pH	6.6
pH adjustment	H_2SO_4 or $NaHCO_3$
Water to account for evaporation	As needed

Feed Schedule

The ten bioreactors were started up on October 15, 2003, using wastewater collected from the SET WWTP influent. Approximately every three weeks throughout the biotreatability study a fresh 250-gallon tote of wastewater was collected from the SET WWTP. Addition of the various samples of pretreated NCH was initiated on October 24. The NCH samples used were the reprocessed 16% NCH obtained early in the study period. Feeds were prepared approximately daily. The base and 4X base test reactors were started at their respective target NCH waste concentrations. If any of the reactors were judged to be exhibiting severe failure, then the reactor NCH feed concentration were to be reduced substantially to restore stability and a slower load-up protocol was to be established. Similarly, if any of the reactors were not exhibiting severe failure, but were judged not to be acclimating after a sufficient period, then the reactor NCH feed concentration were to be reduced substantially and a slower load-up protocol was to be established to try to achieve acclimation. (Note that neither of these scenarios occurred during the study.)

[8] 29 hours excludes the HRT of the SET WWTP secondary clarifiers. This is a conservative approach.

The "very slow acclimation" test reactor was started at 25% of the base NCH waste concentration. After 3 weeks the NCH loading was brought to 50% of the base load. After 4 more weeks it was brought up to full base load. After an additional week each, NCH loadings were brought to 1.5 and 2 times the base load.

The reactors continued running in the initial feed configurations (with one exception) until December 15. The exception was that the peroxide pretreated DCC NCH that was being added at low rates (Reactor 4) was increased during this period from 25% of base NCH loading initially to 50% loading on November 12, as explained in the previous paragraph.

On December 15, changes were made to some of the feeds in anticipation of feeding "actual" (*i.e.*, not reprocessed) NCH in some reactors. Reactor 2 was switched from peroxide-treated, steam stripped DCC NCH to the same without stripping. This meant that it temporarily received the same feed as Reactor 3. Similarly, Reactor 6 was switched from Fenton-treated, steam stripped DCC NCH to the same without stripping, thereby receiving the same feed as Reactor 7. Reactor 10 was changed from the pH adjusted DCC NCH to peroxide-treated DIC NCH, thereby receiving the same feed as Reactor 8. At this time Reactor 4 feed was increased to the base load rate of DCC NCH, the same as Reactors 2 and 3.

On December 18, some of the reactors that had not experienced feed changes a few days earlier were then switched from reprocessed to "actual" NCH. These included the base loaded NCH for peroxide treated DCC NCH (Reactor 3), peroxide treated DIC NCH (Reactor 8) and Fenton treated DCC NCH (Reactor 7). The pretreatments remained the same. Figure 5 summarizes the changes made during the study.

Figure 5.
Changes in Bioreactor Feed Conditions over the Course of the Study

Unit	10/24-11/12	11/12-12/15	12/15-12/18	12/18-1/8
1	Control	Control	Control	Control
2	NPSBC-r	NPSBC-r	NPBC-r	NPBC-r
3	NPBC-r	NPBC-r	NPBC-r	NPBC-a
4	NPLC-r (1/4)	NPLC-r (1/2)	NPxC-r-Incr	NPxC-r-Incr
5	NABC-r	NABC-r	NABC-r	NABC-r
6	FSBC-r	FSBC-r	FBC-r	FBC-r
7	FBC-r	FBC-r	FBC-r	FBC-a
8	NPBI-r	NPBI-r	NPBI-r	NPBI-a
9	NP4xC-r	NP4xC-r	NP4xC-r	NP4xC-r
10	NBC-r	NBC-r	NPBI-r	NPBI-r

Key to abbreviations:

N	Neutralized (pH reduced) with sulfuric acid
P	Preferred oxidant (Peroxide treated)
A	Alternate oxidant (Oxone® treated)
F	Fenton treated
S	Steam stripped
B	Base loading case (1 truck/day of 16% NCH)
L	Low loading case (slow acclimation with gradual loading of NCH)
4x	4x loading case (4 trucks/day of 16% NCH)
x	Loading case other than those above
Incr	Further designation of the loading case "x" - essentially increasing from 1/2 to 1 to 1.5 to 2 trucks/day)
C	NCH with DCC stabilizer
I	NCH with DIC stabilizer
a	Actual NCH
r	Reprocessed NCH (reprocessed with caustic after initially not meeting clearance requirements)
	Change in fill color indicates reactor condition (feed) was changed beginning in this time period

Feed, Effluent, and Reactor Characterizations

The parameters listed in Table 2, below, were monitored weekly for all reactors. Grab samples were used for feed and reactor analyses, whereas 24 hour composite samples were used for the effluent analyses. In addition, toward the end of the test, effluents were collected for aquatic toxicity screening studies that can be used to evaluate effluent toxicity *vis-à-vis* the permit requirements for whole effluent toxicity of the SET WWTP outfall.

Table 2.
Analytical Sampling Schedule

Sampling Frequency

Parameter	Influent/Week	Effluent/Week	Reactor/Week
Flow	7	7	-
DOC	5	5	-
Soluble COD	3	3	-
Total COD	3	3	-
BOD_5	1	1	-
NH_3-N	1	1	-
Total P	3	3	-
PO_4	3	3	-
NO_2-, NO_3-	3	3	-
TSS/VSS	1	3	-
MPA, EMPA, thiolamine[9]	1	1	-
MLSS, MLVSS	-	-	3
Temperature	-	-	7
pH	7	7	7[10]
Dissolved Oxygen	-	-	Continuous
OUR (Oxygen Uptake Rate)	-	-	3
TDS (Total Dissolved Solids)	1	1	-
SVI (Sludge Volume Index)	-	-	1
Composite saved		1	

Analyses of the reactor influent and effluent employed fully developed analytical methods at DuPont, as well as methods provided by Shaw (MPA, EMPA and thiolamine). Each method was verified by spiking a background sample of wastewater with a known quantity of standard to ensure recovery. The detection limit and precision of the method was evaluated. Analytical instruments were calibrated and the samples were run using controls and known standards. Data were collected for record-keeping in a laboratory notebook or electronically and reviewed by a technically qualified employee to ensure accuracy.

[9] The analytical method for thiolamine was not obtained until near the end of the study. It was determined that the oxidant-pretreated NCH had essentially all the thiolamine removed so that there was no need for monitoring those bioreactors. Therefore, only the effluent from the reactor with pH adjusted, but un-oxidized, NCH in the feed was analyzed for thiolamine.

[10] pH was continuously, automatically controlled, but a manual observation was reported once/day.

Evaluation Criteria

Criteria for assessing effectiveness of the various treatability conditions (*i.e.*, each pretreatment and bioreactor condition) includes DOC removal efficiency, effluent performance *vis-à-vis* NJPDES permit parameters of principle concern, a number of bioreactor operational parameters, and odor.

The SET WWTP discharges its treated wastewater under a New Jersey Pollutant Discharge Elimination System (NJPDES) permit that contains limits on a fairly lengthy list of pollutant parameters, many of which will not be impacted by NCH. Table 3 lists the NJPDES permit limits that are relevant to this study.

Table 3.
Relevant SET NJPDES Permit Limits

Parameter	Daily Maximum (kg/day)	Monthly Average (kg/day)	Equivalent Maximum Concentration (mg/L)	Equivalent Average Concentration (mg/L)
BOD_5	NA	3202	NA	84[a]
BOD_5 removal	NA	87.5%-89.9%[11]	NA	NA
TSS	13022	4056	344 [a]	107 [a]
NH_3-N	6745	5246	117 [b]	91 [b]
Acute Toxicity (LC50)	$\geq$50%	NA	NA	NA

[a] Equivalent Maximum and Average Concentrations for BOD_5 and TSS assume typical SET WWTP flow of 10 MGD. There are no concentration limits for these parameters.
[b] NH_3-N limits are applied at the site outfall. The values shown are back-calculated to the equivalent value applicable at the WWTP discharge.

Based on the permit limits listed in the Table, a performance criterion for effluent BOD_5 was set at 84 mg/L average and BOD_5 removal was required to exceed 87.5-89.9%.

While there was a goal to meet the NJPDES permit limits for TSS, it must be recognized that effluent suspended solids results from bench-scale reactors are not indicative of full-scale WWTP performance. Thus, the TSS values shown in the table were not set as success criteria.

[11] The BOD percent removal limit is determined based on the weighted average contributions of BOD from waste within and outside the Delaware River Basin. The waste from inside the DRB is weighted based on 87.5% removal of BOD and outside the DRB is 100% removal. In this study, the maximum overall BOD removal required would have been 89.9%.

Somewhat similar to TSS performance in bench-scale reactors, other indicators of bioreactor stability do not lend themselves to "bright-line" criteria. These include foaming tendency and sludge volume index (SVI). In all cases these parameters are taken into account when making recommendations for full-scale operational management practices, and if found to be problematic they would have launched measures to mitigate issues in the bench-scale units (*e.g.*, use of anti-foam if foaming were too great an operational problem).

Whole effluent toxicity (WET) is a permit parameter of concern. However, the study did not generate sufficient sample to conduct the testing by the full protocol required under the permit. Therefore, a WET screening test was to be developed to compare the performance of the test reactors and the control in regards to effluent toxicity. The test protocol actually used was only a slight modification from the EPA protocol for acute toxicity in Fathead minnow that is routinely employed for NJPDES permit compliance monitoring of the SET WWTP effluent.[12] The only difference was a reduction in the number of replicate organisms by half in order to reduce sample volume needed. In addition, tests using 100% effluent were not performed, again to reduce sample volume requirements. This meant that LC50 values exceeding 50% could not be quantified. This was considered to be acceptable since any values exceeding 50% would be meeting the permit limit condition. It was anticipated that the LC50 values for the effluents could potentially be under 50% since only the first stage of the two-stage PACT® process was simulated in the study. Therefore, the evaluation criterion for whole effluent toxicity was that the test effluents should be approximately the same as the control bioreactor effluent. The protocol is outlined below:

- Fathead minnow acute toxicity test
- 96-hours in duration
- Static acute with daily renewal of effluent
- 2 replicates of 5 organisms

[12] USEPA. October 2002. *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms*. Fifth Edition. U.S. Environmental Protection Agency, Office of Water, Washington, D.C. EPA 821-R-02-012.

- Concentration Series: control, 3.125%, 6.25%, 12.5%, 25%, 50% dilution of sample
- Test dilution water: Moderately hard synthetic freshwater
- Test Temperature: 20^{o}C
- 2.5% CO_2 headspace to maintain constant pH
- Each effluent sample submitted analyzed for alkalinity, hardness and conductivity.
- Standard Water Quality parameters (temperature, pH, dissolved oxygen and conductivity) performed on one replicate of each concentration at test initiation, and every 24 hours.

Odor criteria are discussed as part of the subsection on Odor Evaluations presented below.

Odor Evaluations

The mixed liquor from each reactor was evaluated for odors at two times: once near the beginning of the test run at the NCH target concentration and once at the end of the study.

In addition, at the end of the study the mixed liquor from each reactor was run through a belt press simulation to form sludge cakes for odor evaluation. The belt press simulation included treatment with clarification polymers representative of those employed at the SET WWTP (*e.g.*, Cytec Magnifloc 2535CH and Cytec Magnifloc 1883A) followed by the dewatering polymer (*e.g.*, Chemtreat P836E, a.k.a. Percol 778FS40). After pressing cakes on the belt press simulator, part was submitted for odor evaluation as is, and part was mixed with "Enviromag" (magnesium lime) at 15% by wet weight of sludge. The application of "Enviromag" represents a treatment that is applied to the SET WWTP biosludge cake prior to landfilling to provide the cakes with mechanical stability. "Enviromag"-treated cakes were odor tested for all reactor sludges, while only the control and two test reactor cakes were odor tested for the sludges not treated with "Enviromag". This was necessary in order to avoid desensitizing the odor panel due to an excessive number of samples.

The odor evaluations employed ASTM Method E544-99, "Standard Practice for Referencing Suprathreshold Odor Intensity". Specifically, Procedure B, the

Static-Scale Method, was used. The odor intensity scale consisted of twelve 125-mL glass jars with screw covers. Jar #12 was made up as an aqueous solution of butanol at 5,000 ppm. Each lower jar was a 1:1 dilution such that the concentrations in jars #1 to #12, respectively, were 2.5, 5, 10, 20, 40, 78, 156, 313, 625, 1250, 2500 and 5000 ppm butanol. 50 mL of the solutions were placed in the jars. Experience has shown that when an odor panel finds SET samples at or above an odor intensity of 5000 ppm butanol, there is potential for odors to be transported beyond the WWTP boundaries. Therefore an odor intensity criterion not to exceed the 5000 ppm butanol intensity level was set for this screening effort.

For the mixed liquor testing, 50 mL samples of mixed liquor from each reactor were placed in separate 125-mL glass jars with screw covers. Identical jars were utilized as those employed in the butanol odor intensity scale. The odor intensity from the mixed liquor in each jar was estimated individually by a panel of eight persons employed by DuPont, which included males and females ranging from about 20 to 55 years of age[13].

For the sludge cakes, after the cakes are prepared, they will be partially broken into random size pieces on the order of ½-1-inch square by ¼-inch thick and placed in separate 125-mL glass jars with screw covers. Identical jars will be utilized as those employed in the butanol odor intensity scale. The jars will be approximately half full. The intensity of the odor from the cake in each jar was estimated individually by a panel of eight persons employed by DuPont, which included males and females ranging from about 20 to 55 years of age.

For all the odor tests – mixed liquor, effluent and sludge – the sample identities were coded so that the panel would not know from which reactor each had been taken.

The success criteria for odor assessment was that odors from the mixed liquor and the sludge cake tests should not exceed a value of 12 on the odor scale (*i.e.*, 5000 ppm butanol) or the odors from the test reactors should not exceed

[13] There were three odor panels convened: one for the pretreatment screening, one for the early evaluation of mixed liquor and one for the final evaluation of mixed liquor and sludge cakes. The first two panels were identical: 3 persons (2 female) aged 20-30, 2 persons 31-50, 3 persons over 50 (1 female). The final panel had similar make-up but two substitutions were necessary: the male under 30 in the first panels was substituted with a female under 30. One male over 50 was substituted with another.

those from the control reactor by more than 2 odor scale units, based on a statistical assessment of the odor panel results (refer to the section of the report entitled "Statistical Evaluations," below). It should be noted that the success criteria for odor assessment originally in the test plan was that odors from the mixed liquor and the sludge cake tests should not exceed a value of 6 on the odor scale (or exceed those the control reactor by more than 2 units). However, the test plan originally called for only 8 jars and a range up to 20,000 ppm. Thus, jar #6 would have had a concentration of 5,000 ppm butanol. After further reviewing experience, it was decided to modify the range to a maximum of 5,000 ppm butanol. Thus, if odor intensities exceeded jar #12, then this would indicate that further work should be considered to assure that odors could be managed in the full-scale system.

The pretreatment screening odor panel study was conducted in an identical manner to the mixed liquor odor panel studies. In this study the samples evaluated were pretreated 16% NCH samples. These samples were diluted with deionized water 500:1 (on the basis of the original 16% NCH concentration). This dilution was selected as it represented the nominal level of dilution that would occur in SET wastewater at four times the base loading rate of 16% NCH. However, since the purpose of the test was to select the preferred pretreatment dosages, the dilution was performed using deionized water rather than SET wastewater so there would be no potential for odor masking by the diluent. The following samples were tested:

(1) 5 cc of pH adjusted 16% NCH (*i.e.*, control)

(2) control + 1 mL of 10 wt% H_2O_2

(3) control + 5 mL of 10 wt% H_2O_2

(4) control + 1 mL of 20 wt% Oxone solution

(5) control + 5 mL of 20 wt% Oxone solution

(6) Fenton chemistry with 200 mg/L Fe + 10 wt% H_2O_2

Dilutions were performed as follows to achieve 500:1 on a 16% NCH basis[14]:

(1) 1 mL sample + 380 mLs deionized water

(2) 1 mL sample + 320 mLs deionized water

(3) 1 mL sample + 190 mLs deionized water

(4) 1 mL sample + 320 mLs deionized water

(5) 1 mL sample + 190 mLs deionized water

(6) 1 mL sample + 230 mLs deionized water

STATISTICAL EVALUATIONS

In evaluating the data generated in this study, there were many instances in which there was a need to determine whether there were statistically significant differences among results. In most cases there was a need to compare a result from a test that included NCH with a control result (*e.g.*, from a test with SET wastewater only). In some cases there was a need to compare results from different NCH tests (*e.g.*, odor after different NCH pretreatments, or bioreactor odor from treatment with actual *vs.* reprocessed NCH). Statistical significance was assessed by determining whether the means of populations of results were statistically different at the = 0.05 level using the Tukey one-way ANOVA method found in the standard Minitab® statistical software package. The Tukey method allows for multiple comparisons and is useful for handling large numbers of different test reactors. An example of Minitab® output using the Tukey method is provided in Appendix J. In addition, similar output are provided with the odor panel results included in Appendix K. Any reference in this report to statistical significance is based on an evaluation using the Tukey method.

[14] To achieve 500:1 dilution on a 16% NCH basis, the amount of reagents added in pretreatment must be taken into account. In all cases, this included first a 30% volume addition of 20% sulfuric acid, followed by the peroxide or Fenton's reagent additions noted above. For example, for sample (2), above, this is:

$$\frac{\text{320 mL deionized water + 1 mL pretreated sample}}{\left(\frac{\text{5 mL pH neutralized control}}{\text{(5 mL + 1 mL } H_2O_2\text{)}}\right) \times \left(\frac{\text{1 mL NCH}}{\text{1.3 mL pH neut control}}\right)} = 500$$

III. Pretreatment Study Results

NCH Sample Characterization

The following NCH samples were received at the DuPont Experimental Station on the dates indicated[15]:

- September 11, 2003: 16% NCH, reprocessed, DCC stabilizer, 1 Liter
- September 11, 2003: 16% NCH, reprocessed, DIC stabilizer, 1 Liter
- September 18, 2003: 16% NCH, reprocessed, DCC stabilizer, 12 Liters
- September 23, 2003: 16% NCH, reprocessed, DIC stabilizer, 3 Liters
- October 30, 2003: 8% NCH, actual ("fresh"), DIC stabilizer, 6 Liters
- December 3, 2003: 8% NCH, actual ("fresh"), DCC stabilizer, 2-400mLs
- December 22, 2003: 16% NCH, actual ("fresh"), DIC stabilizer, 2 Liters

Full characterizations for these NCH samples are presented in Appendix A. Key parameters are summarized in Table 4. Note that averages and standard deviations are shown for these analytical results normalizing all the values to 16% NCH (*i.e.*, doubling the values obtained for the 8% NCH, with the exception of pH and specific gravity). The 16% NCH contained approximately 8 wt% TOC. This was reasonably consistent with the characterization data for full strength (14 wt% TOC) hydrolysate which had been reprocessed in the laboratory by one part reagent to one part 33% NCH. Moreover, the average TOC and DOC results were very close to the value that was calculated stoichiometrically, aso shown on the table. The total phosphorus results appear to agree with the total of the EMPA and MPA results. Again, the average concentration of total phosphorus agreed closely with the value that was stoichiometrically determined. The total reduced sulfur as determined by ICP showed fair agreement with stoichiometry, as the values appeared to be lower than expected by about 25%. On a molar basis, the concentrations of phosphorus and reduced sulfur would be expected to be the same since the starting material contained a molar equivalent of each. There may have been some conversion of the sulfur to sulfate in the hydrolysis reaction.

[15] Note that, prior to shipping, all NCH samples were generated and cleared per the protocols described in the following draft report: U.S. Army Chemical Materials Agency (Provisional) Program Manager for the Elimination of Chemical Weapons, *Generation and Clearance of VX Hydrolysate*, October 2003.

Table 4.
Characterization of NCH Samples

Date Rec'd	Description	pH SU	Sp.G. kg/L	DOC mg/L	TOC Mg/L	COD,t mg/L	COD,s mg/L
9/11/2003	16% NCH, reprocessed, DCC	12.6	1.101	78,360	72,406	156,400	181,600
9/11/2003	16% NCH, reprocessed, DIC	12.9	1.105	72,340	75,558	158,400	174,400
9/18/2003	16% NCH, reprocessed, DCC	13			85,307	187,000	108,500
9/23/2003	16% NCH, reprocessed, DIC	13				192,500	166,000
10/30/2003	8% NCH, actual (“fresh”), DIC	13.1	1.092	49,680	44,147	99,500	43,500
12/3/2003	8% NCH, actual (“fresh”), DCC	12.5	1.107	47,460	46,443	106,500	55,000
12/22/2003	16% NCH, actual (“fresh”), DIC	13.0	1.058	92,400	87,606	231,000	99,500
Average (all samples normalized to 16% NCH)		12.9	1.093	87,476	83,676	191,043	132,429
Std Deviation (normalized to 16% NCH)		0.23	0.020	11,544	7,965	27,161	39,854
Concentrations expected by stoichiometry in 16% NCH				7.91%	7.91%		
Concentrations expected by stoichiometry in 16% NCH assuming Sp.G. = 1.1				87,000	87,000		
Date Rec'd	Description	Total N mg/L	Total S mg/L	Total P mg/L	EMPA Mg/L	MPA mg/L	Thiolamine ppm
9/11/2003	16% NCH, reprocessed, DCC	9,010		23,400	72,891	7,672	
9/11/2003	16% NCH, reprocessed, DIC	9,684		20,200	66,779	6,819	
9/18/2003	16% NCH, reprocessed, DCC	9,323	18,700	19,800	64,896	8,904	50,600
9/23/2003	16% NCH, reprocessed, DIC						
10/30/2003	8% NCH, actual (“fresh”), DIC	4,334	8,107	10,900	35,937	2,826	42,900
12/3/2003	8% NCH, actual (“fresh”), DCC	4,639	7,630	10,400	33,656	3,764	
12/22/2003	16% NCH, actual (“fresh”), DIC	9,970	15,660	21,900	78,817	6,782	
Average (all samples normalized to 16% NCH)		9,322	16,459	21,317	70,428	7,226	68,200
Std Deviation (normalized to 16% NCH)		464	1,545	1,321	5,141	1,091	24,890
Concentrations expected by stoichiometry in 16% NCH		0.84%	1.92%	1.86%			
Concentrations expected by stoichiometry in 16% NCH assuming Sp.G. = 1.1		9,200	21,100	20,400			

Analytical results in gray shaded cells were performed at the SET laboratories in Deepwater, NJ. The remainder of the analyses were performed at the DuPont Experimental Station near Wilmington, DE.

Based on the characterization of these samples, a Preliminary Waste Characterization Profile Sheet was developed as provided in Appendix B.

pH Titrations

Titration curves for the 16% reprocessed NCH samples were developed. The DCC-stabilized NCH titration curve is shown in Figure 6. The curve for the DIC-stabilized NCH is shown in Figure 7. The data supporting the development of these curves is shown in Appendix C.

Figure 6.
Titration Curve for DCC NCH

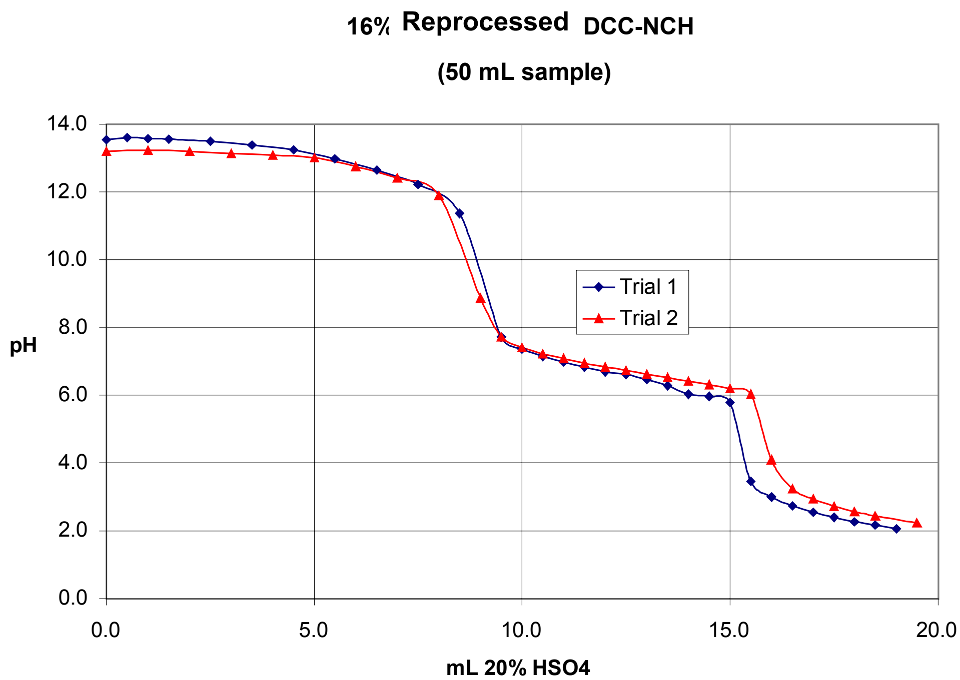
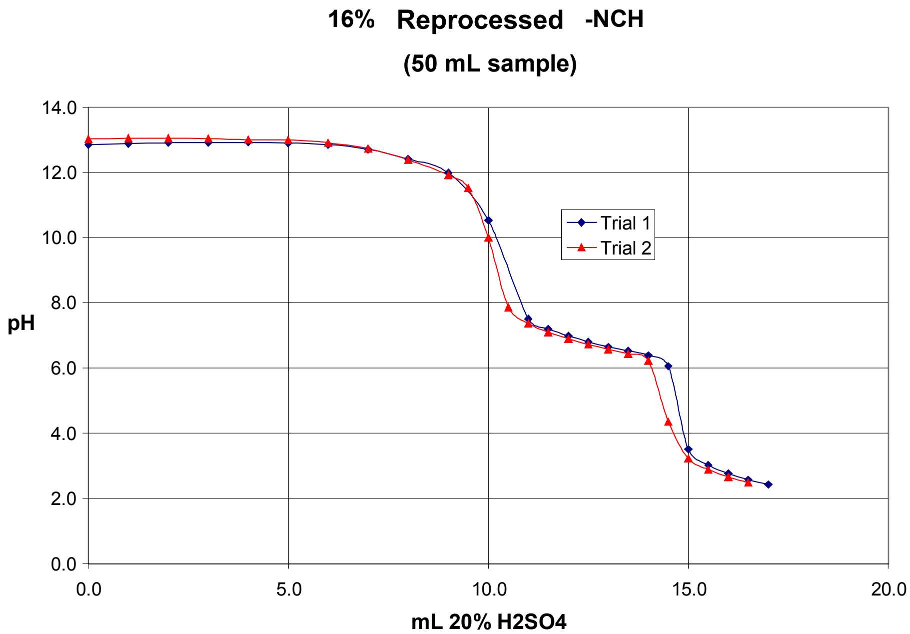


Figure 7.
Titration Curve for DIC NCH



Initial Observations

The odor of NCH, which had a high pH (i.e. > 12), was not as intense as expected. For example, the sample could be managed inside a laboratory hood without the need for specialized handling procedures to control potential odors outside of the building. The odor of high pH NCH was far less in intensity than some materials routinely treated at the SET WWTP.

An 800 ml sample of 16% NCH was poured into a 2 L beaker. It did not contain any settled solids. The sample was yellowish to amber in color. A small sub-sample was centrifuged for about 10 minutes in a small tabletop centrifuge. A top organic layer of approximately 2% by volume was observed. The organic material stuck to glassware.

Flashpoint

Flashpoint testing was performed with the aqueous layer of NCH and, when a definable organic layer was present, flashpoint testing was performed with the separate phase, as well. None of samples had a flash point at 200°F. Therefore, NCH would not be defined as either flammable or combustible under DOT regulations (40 CFR 173.120).

pH Adjustment

A 50% solution of sulfuric acid was initially used to adjust the pH of the NCH sample. For reaction screening purposes, 5 cc of sample were placed into 20 cc reaction vials with tops and mixed gently after acid was added. The sample was observed to change from a yellowish cloudy color to a slightly amber clear color once a single phase was formed which occurred around pH 6.0. Once a single phase formed, there was no longer any organic material coating the glass.

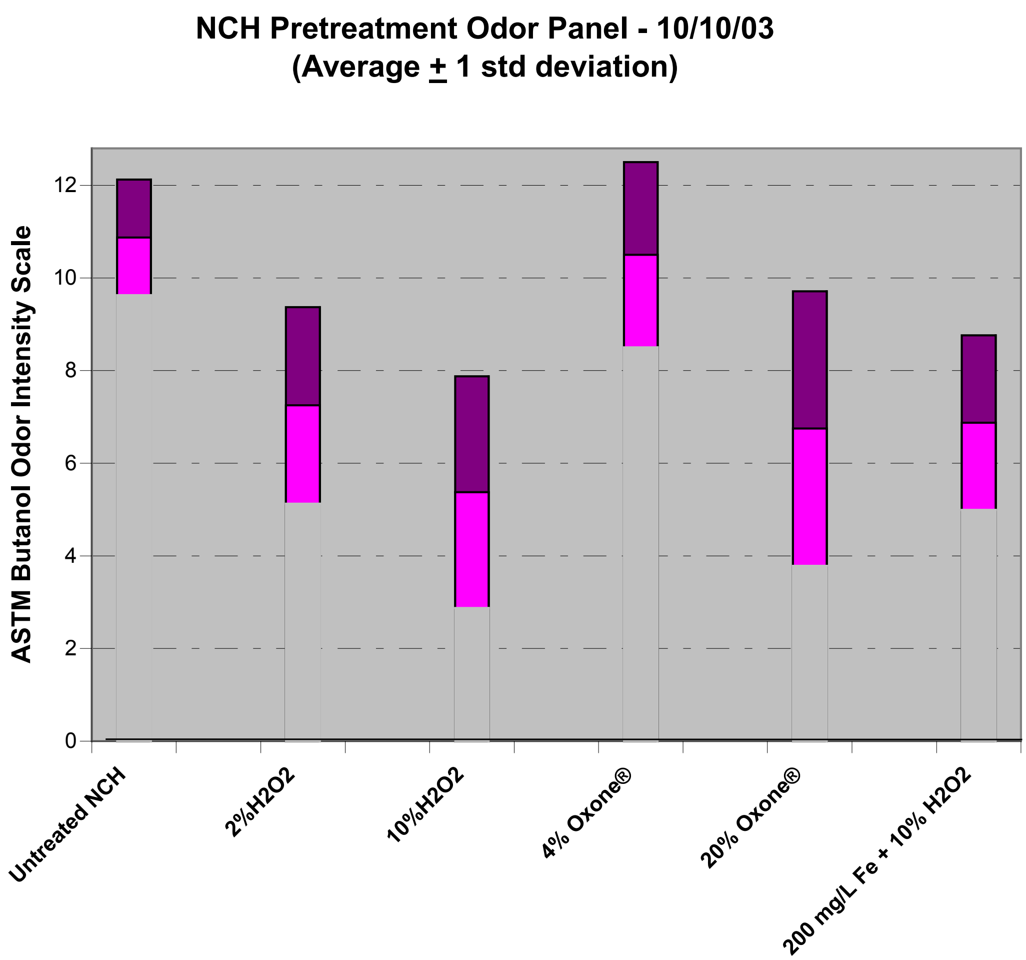
The sample, which was pH adjusted to 6.0, had a much more intense odor than the high pH NCH. Even upon 1:1000 dilution in water, the odor was still detectable.

To prepare samples for biotreatability study, a larger (500 cc) sample of NCH was pH adjusted using a beaker and a magnetic stirrer and 50% H_2SO_4. When the sample reached pH 6.0, it contained a large amount of suspended material. The sample was not a clear single phase. Apparently, the sample did not behave the same as compared to neutralization in a 20 cc reaction vial. Also, the resulting pH adjusted sample did not behave the same with H_2O_2 in that the resulting H_2O_2 treated sample remained substantially odorous. It was postulated that the shear created by the magnetic stirrer created an emulsion that did not behave the same. When the acid was added into a larger bottle and gently mixed, a clear, single phase, pH adjusted sample was produced. Therefore, manually mixing in a closed bottle was used to pH adjust samples. However, additional observations on pH adjustment using concentrated H_2SO_4 indicated that the heat of neutralization and exposure to air in the headspace of the neutralization flask created a precipitate (as indicated by the cloudy sample at pH 6.0). When using 20 wt% sulfuric acid, the exotherm was much less and no precipitate was observed. Therefore, 20 wt% sulfuric acid was used to prepare samples for subsequent pretreatment step. Further observations on pH adjustment using 20 wt% H_2SO_4 in a stirred flask indicated that a clear single phase could be produced. Note that in the full-scale system, there will be sufficient agitation to assure that there is no significant organic layer during pH adjustment and oxidation. As was observed here, no separate organic phase should be present after these steps are performed.

Odor Evaluations on Pretreated NCH

Five pretreatment schemes were evaluated for odor as compared with a control pretreatment of pH adjustment only. These included two different peroxide doses after pH adjustment to the 6.0-6.5 range, two different Oxone® doses after pH adjustment in the same range, and one Fenton test followed by pH adjustment to the same range. As mentioned earlier, after pretreatment the samples were all diluted with deionized water at a 500:1 ratio based on the original 16% NCH concentration. The results of the odor panel evaluation are illustrated in Figure 8. It was found that treatments with roughly 2% peroxide, 10% peroxide, 20% Oxone® and Fenton with 200 mg/L iron and 10% peroxide were all effective in reducing odors. 4% Oxone® was not effective. There was little improvement in odor results by increasing the peroxide dose from 2% to 10%. The statistical evaluation of the odor panel results of the NCH pretreatment tests showed there was a significant reduction in odor achieved using 2% peroxide, 10% peroxide, 20% Oxone® or the Fenton dose as compared with the control. No significant difference was shown for the 4% Oxone® and there was no significant difference in odor between the 2% and 10% peroxide doses.

Figure 8.



Evaluations of the Impact of Pretreatments on EMPA, MPA and Thiolamine

Most of the work on the impact of various pretreatments on specific NCH compounds focused on EMPA and MPA since methods for thiolamine were not available until late in the study. It was found that hydrogen peroxide and Oxone® each had minimal effect on the total amount of EMPA and MPA in the sample. Table 5 shows representative results from testing with 10% and 20% peroxide reagents (that is, treatments of 16% NCH with 10% H_2O_2 at 1:1 and 2:1 volume ratio of peroxide to NCH) and 10% Oxone®. After accounting for dilution and for the different molecular weights of EMPA and MPA, it is apparent that there was little reduction in the total concentrations of phosphonates (EMPA plus MPA) due to the treatments – 15% at most. There was some conversion of EMPA to MPA evident, as EMPA reduction was on the order of 20%.

Table 5.
Peroxide and Oxone® EMPA and MPA Results

					Normalized to MPA				Excluding Dilution				
All values mg/L	EMPA	MPA	DOC	TN	EMPA as MPA	MPA	Total EMPA + MPA	Reagent Volume %	DOC	TN	EMPA as MPA	MPA	Total EMPA + MPA
Original 16% NCH sample (DCC stabilizer)	72,891	7,672	72,406	9,010	56,432	7,672	64,104	0	72,406	9,010	56,432	7,672	64,104
Sample adjusted to pH 6 with 50% sulfuric			66,726	8,001				12	74,733	8,961			
pH adjusted sample with 10% peroxide	26,285	4,183	30,224	3,510	20,350	4,183	24,533	224	67,702	7,862	45,583	9,370	54,953
pH adjusted sample with 20% peroxide	17,625	2,857	22,504	2,561	13,645	2,857	16,502	336	75,613	8,605	45,848	9,600	55,447
pH adjusted sample with 10% Oxone®	25,504	3,888	31,050	3,259	19,745	3,888	23,633	224	69,552	7,300	44,229	8,709	52,938

Similarly, Fenton chemistry testing yielded only slightly better results, with reductions on the order of at most 10% better than peroxide alone. Table 6 presents representative results from the Fenton reagent work. Note that the last row in the table represents a repetition of the “10% peroxide” test shown in the previous table. The iron and peroxide dosages listed in the table are the totals of 10 equal doses applied over a period of time, as described in the methods section.

Table 6.
Fenton Reagent EMPA and MPA Results

			All values mg/L unless otherwise noted						
Fenton Test Description				Normalized to MPA			Excluding Dilution		
Fe dose, mg/L	H2O2 dose	Temp, °C	EMPA	EMPA as MPA	MPA	Total	EMPA as MPA	MPA	Total
0	0	-	72,891	56,432	7,672	64,104	56,432	7,672	64,104
200	10%	RT	22,347	17,301	5,455	22,756	38,754	12,219	50,973
200	10%	80	19,077	14,769	7,877	22,646	33,083	17,644	50,728
200	2%	RT	24,431	18,914	3,697	22,611	42,368	8,281	50,649
400	10%	RT	20,969	16,234	4,941	21,175	36,364	11,068	47,432
0	10%	RT	25,596	19,816	3,911	23,727	44,388	8,761	53,149

Analysis of pretreated NCH samples for thiolamine was completed during the final weeks of the study. It was determined that pretreatment with 20 volume percent of 10% H_2O_2 (*i.e.*, 2% peroxide in the 16% NCH) reduced thiolamine concentrations below the detection limit. Degradation products after peroxide treatment were identified as acetic acid, diisopropylamine, N,N'-diisopropylurea and 2-diisopropylaminoethyl disulfide. It is known that the thiolamine will oxidize in part to diisopropylaminoethyl disulfide and it is suspected that the diisopropylamine and diisopropylurea also were formed from the thiolamine. The acetic acid may have been a product of the conversion of EMPA to MPA. A report on the analytical method and on the results is presented in Appendix E.

Steam Stripping

Steam stripping was simulated on two pretreated NCH samples using batch distillation. The samples were (1) pH adjusted, hydrogen peroxide pretreated, and (2) pH adjusted, Fenton reaction pretreated. Approximately 15 grams of overhead samples were collected up to a temperature of approximately 104°C. Table 7 shows the COD results comparing the overhead samples to the bottoms samples. Based on these results, there was a minimal amount of volatile organic material in the pretreated NCH. Stream stripping would not be useful for recovering any significant amount of organic materials.

Table 7.
Steam Stripping Simulation Test Results

	COD (mg/L)		
	Feed*	Bottoms	Overheads
pH & H2O2	105,000	110,500	80,100
Fenton	59,000	59,500	89,000

* **Feed COD values** calculated from mass balance based on dilution of original NCH sample with pretreatment reagents (*e.g.*, sulfuric acid, peroxide, ***etc.***)

Samples Pretreated for Biotreatability Study

As a result of the pretreatment studies, it was determined that the "preferred" pretreatment (per the terminology in the study plan) was hydrogen peroxide treatment at a dosage of 2% H_2O_2 on the basis of 16% NCH after pH adjustment to 6.0-6.5 with sulfuric acid. The "preferred" pretreatment method was to be used in five of the biotreatment reactor studies. The "alternate" oxidant to be tested was Oxone® at a dosage of 20%, which provided the oxygen equivalent of the peroxide dosage selected. This was to be used in one bioreactor test. Fenton chemistry dosages were set at 200 mg/L iron and 10% H_2O_2 and used in two bioreactor tests.

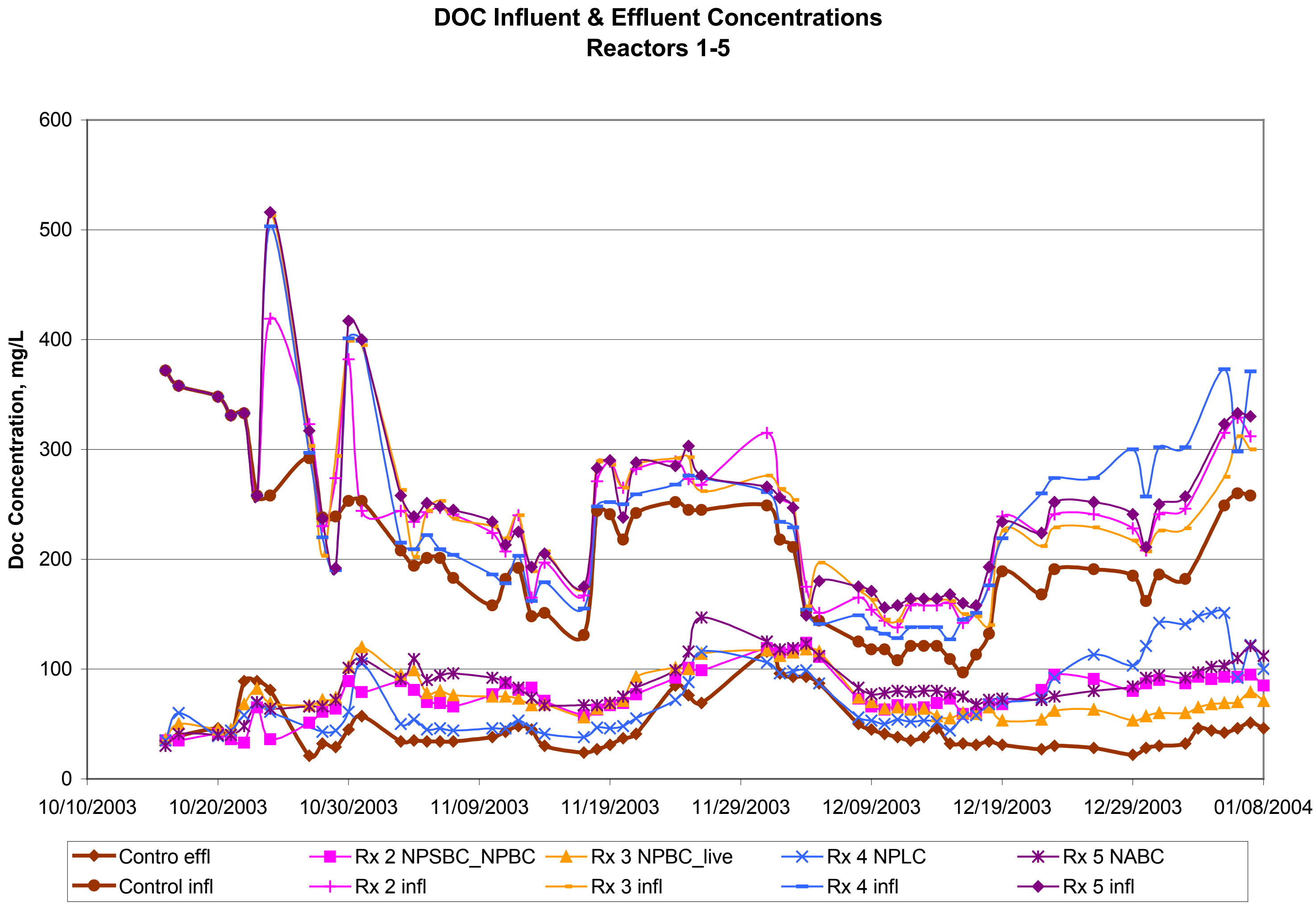
IV. Biotreatability Study Results

Biotreatment Reactor Performance

Discussion of the performance of the reactors will be focused on two phases of study that will be described as the reprocessed NCH study period (October 24-December 15) and the period of comparison between actual and reprocessed NCH (December 18-January 8).

First, however, Figures 9 and 10 present the variation of influent and effluent DOC with time for the first five and second five sets of bioreactors. In the former figure, it is apparent that the influent concentrations for the test reactors are all grouped above the control influent and similarly the effluents are somewhat greater than the control effluent DOC. In the latter figure, again, the effluents for the test reactors are somewhat higher than for the Control. The exception is that the reactor receiving four times the base load of NCH (Reactor 9) is significantly greater in effluent DOC than the others. Note that in this figure the only influent shown is for the Control reactor so that the relatively high effluent DOC values for Reactor 9 would not be masked by the other reactor influents. Those influents were essentially at the same DOC levels as the test reactors in Figure 9.

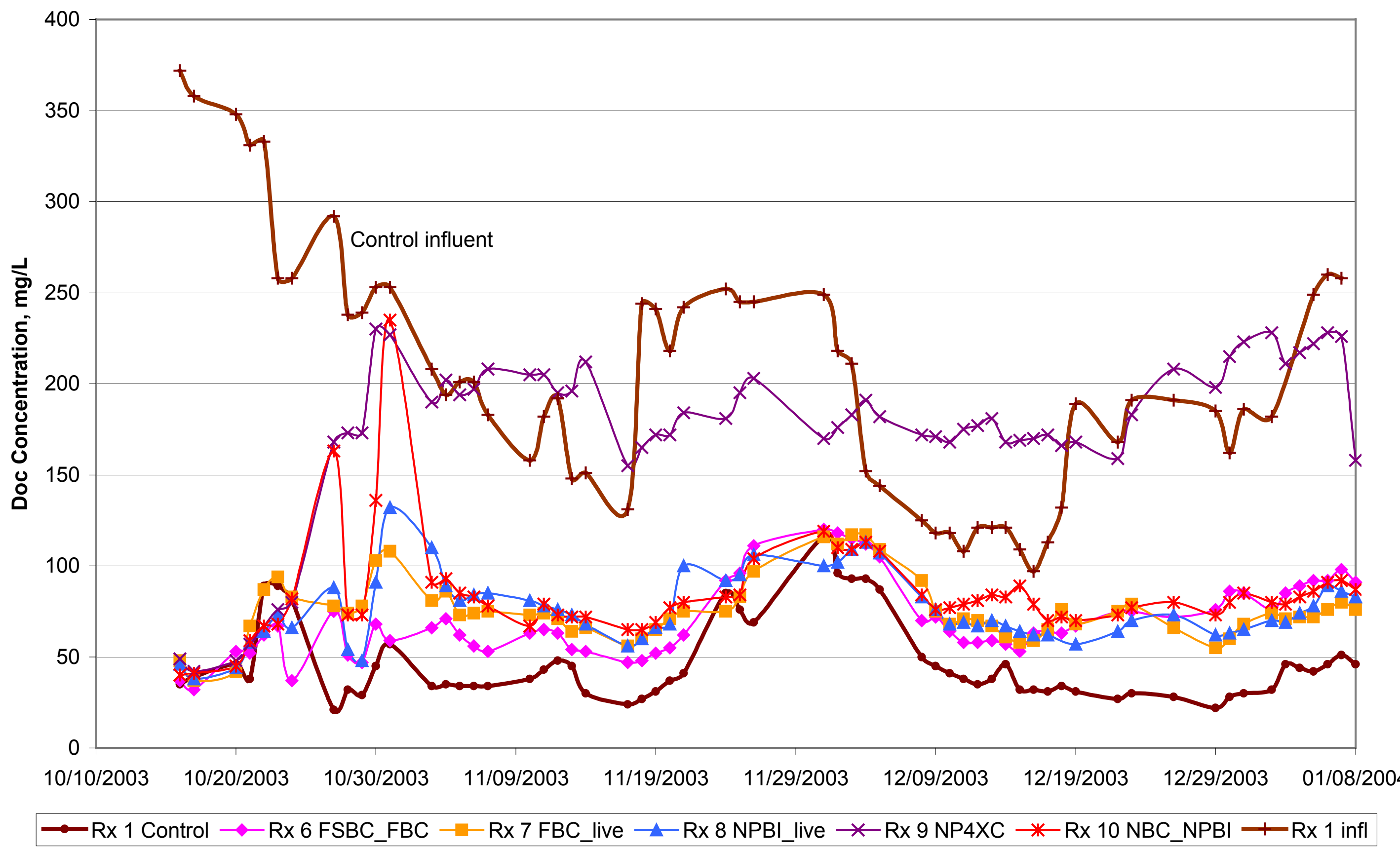
Figure 9.


DOC Influent & Effluent Concentrations
Reactors 1-5
Doc Concentration, mg/L
600
500
400
300
200
100
0
10/10/2003
10/20/2003
10/30/2003
11/09/2003
11/19/2003
11/29/2003
12/09/2003
12/19/2003
12/29/2003
01/08/2004
Contro effl
Control infl
Rx 2 NPSBC_NPBC
Rx 2 infl
Rx 3 NPBC_live
Rx 3 infl
Rx 4 NPLC
Rx 4 infl
Rx 5 NABC
Rx 5 infl

ure.

Figure 10.

**DOC Effluent Concentrations
Reactors 6-10**



It was noted that from late November through December wastewater organic parameters (notably DOC and BOD) were significantly lower than average, although within normal ranges. This low organic level reduced the apparent removal efficiency of the study bioreactors, including the control, below routine levels, although effluent concentrations remained low (below 100 mg/L on average, except for the reactor that was highly loaded with NCH, Reactor 9, the "4X" reactor). There was also a brief period of time (a few days around December 3) in which it was found that the feed to the bioreactors was severely inhibitory. It was determined that one of the 55-gallon drums used to collect wastewater from the 250-gallon tote and deliver it to the laboratory contained inhibitory contaminant materials. This briefly compromised the performance of the entire set of study reactors. However, as can be seen in Figures 9 and 10, above, routine operation was quickly recovered upon discovery and correction of the problem.

It may be better to compare influent and effluent values for DOC, BOD and other parameters over the course of the phases of the study. Figures 11 and 12 show the influent and effluent DOC concentrations during the reprocessed NCH study phase. In all cases the average effluent DOC concentrations are higher in the test reactors than in the Control, but the differences are not as great as the corresponding averages for the influents, indicating that removal of compounds associated with NCH is occurring through the bioreactors. The 4X loaded reactor stands out from the standpoint of both the influent concentration and the effluent concentration, but a similar conclusion can be drawn.

Figure 13 shows the influent and effluent DOC concentrations during the period of comparison of the actual ("fresh") and reprocessed NCH samples. Only those reactor pairs that compare the performance of the actual and the reprocessed NCH are shown. Effluent DOC values for the actual ("fresh") NCH reactors were lower in all cases than the sister reactors treating reprocessed NCH. For the peroxide-pretreated DCC NCH pair, the effluent DOC and percent DOC removal were statistically better for the actual than for the reprocessed material. However, the figure shows that there was little fundamental difference in DOC removal performance in the bioreactors treating actual ("fresh") NCH and those treating reprocessed NCH, and this was borne out by the fact that there was no statistical difference for the other two pairs of reactors.

Effluent BOD_5 concentrations were excellent throughout both study periods, as seen in Figures 14 and 15. All were well below the concentration-equivalent permit limit of 84 mg/L, even though only one stage of PACT® was used in the study. There were no statistical differences in average effluent BOD_5 concentrations between any of the NCH reactors and the control. Similarly there were no statistical differences between the effluents in each pair of actual and reprocessed NCH reactors. Note that the analysis for BOD_5 used a filtered sample (*i.e.*, the values reported are soluble BOD_5). Effluent TSS will contribute a slight additional BOD_5 but this will have negligible impact on the ability to maintain compliance with the BOD_5 permit limit.

It should be mentioned that there was some indication of inhibition of the BOD_5 test for the 4X loaded reactor effluent as lower dilutions (high sample concentrations) at times resulted in lower oxygen demands. There were no such problems in any of the other reactor influents or effluents. It is difficult to speculate whether a second stage of PACT®, as in the full-scale WWTP, would remedy the issue. A respirometry study using the PACT® seed from the SET WWTP fed with various concentrations of pretreated (pH adjustment only and pH adjustment with oxidation) NCH in WWTP feed was conducted prior to the initiation of the biotreatability study. The work was not part of the formal treatability study plan but had been performed to provide the client with a preliminary determination of the likelihood of success of the treatability work. The results of that study indicated that there were no inhibitory impacts on the WWTP biomass due to NCH concentrations as high as those in the 4X loaded reactor in the biotreatability study. Appendix G provides a report on the results of the respirometry study.

BOD_5 removal percentages were also excellent throughout both study periods, as seen in Figures 16 and 17. All were above the permit limit of 87.5-89.9% removal calculated for the cases studied, even though only one stage of PACT® was used. There is no question that a second stage would increase the percent removal even further as biological degradation continued. There were no statistical differences in average BOD_5 removals between any of the NCH reactors and the control. Similarly there were no statistical differences between the BOD_5 removals in each pair of actual and reprocessed NCH reactors.

Although the NJPDES permit imposes TSS limits (refer to Table 3), TSS performance of the bioreactors used in this study was not set as a quantifiable performance criterion. As explained in an earlier section, experience with these small reactors is that effluent TSS is not indicative of – and often poorer than – full-scale performance. The full-scale system is designed to enable controls such as changing of recycle rates and addition of coagulants and flocculants in order to prevent upsets. The laboratory reactors do not allow this. However, Figures 18 and 19 do show that effluent TSS concentrations for all reactors averaged well below the concentration-equivalent monthly average permit limit for TSS. All of the NCH reactors showed greater averages than the control reactor, some of which were statistically significant. However, it must be recognized that performance was well below the permit limit even without the ability to initiate any of the aforementioned control actions in the laboratory-scale system.

Effluent ammonia (NH_3-N) concentrations were consistently well below the permit limits described in Table 3. In fact, for most of the study, several of the NCH reactors performed significantly better than the control. No figure is provided for this (although the data is available for examination in Appendix I), because it would be misleading. The level of NH_3-N in the effluent is contingent upon the degree of nitrification occurring in the WWTP. For the purposes of understanding the potential for compliance with the permit limits for NH_3-N, a stoichiometric mass balance is the most appropriate basis. As similarly described for sulfur in the Methods section of this report, there is one mole of nitrogen (molecular weight of 14 gms/mole) in a mole of the original agent (molecular weight 267 gms/mole) prior to hydrolysis. This means that 16% NCH should contain 0.84% (or 8400 ppm) nitrogen. At a rate of 7000 gpd of 16% NCH in a WWTP flow of 10 MGD, the additional concentration of nitrogen added to the wastewater by the NCH would be only 5.9 mg/L, a negligible amount even if it were all hydrolyzed to NH_3-N and none of this ammonia was nitrified or used for biomass synthesis.

Whole effluent toxicity results for Fathead minnow were acceptable, in general (see Table 8). Almost all the reactor effluents met the permit limit of LC50 $\geq$ 50%, even though only a single-stage of PACT® treatment was used in the study. (The actual SET WWTP effluent was in compliance with the whole effluent toxicity limit during the period of time that the wastewater samples were drawn for this study.)

Among the first samples run, Reactor #2 showed an LC50 for which the calculated mean was slightly below the limit, but the confidence range for this result exceeded the limit. Further, a re-test on a sample a week later showed a result that clearly met the limit of LC50 $\geq$ 50%. It should also be noted that the same NCH material (peroxide pretreated, DCC stabilized NCH) met the limit with double the loading (Reactor #4) in both test runs.

Similarly, Reactor #3 showed an LC50 that did not meet the limit the limit in the first test sample. However, this sample was re-run and effluent from this reactor was re-run twice more, (samples from one and two weeks later). Both of these results clearly met the LC50 limit. Based on the results from the latter two samples together with the successful results for the related samples, it was concluded that the apparent toxicity associated with the initial sample from Reactor #3 was not associated with any toxicity associated with the treatment of the NCH but an experimental artifact.

Finally, the results from Reactor #9 – the reactor loaded at four times the base concentration of peroxide pretreated NCH, indicated slightly lower results in the first sample, but passed on the second test. After this, the reactor was shut down, so there was no opportunity to perform a third run. Thus, it is inappropriate to conclude that this level of NCH loading is acceptable. If NCH loadings above 10,000 gpd (*i.e.*, above the "2X" loading demonstrated by Reactor #4) of 16% NCH are to be considered, further investigation would be needed.

In summary, the effluents from reactors treating pretreated NCH met the whole effluent toxicity limit (LC50 $\geq$ 50%) performed as well as or better than the control with the possible exception of the 4X loaded reactor (Reactor 9). A second stage of PACT® may bring the LC 50 of all the effluents up, as is the experience in the plant. The complete data set for Whole Effluent Toxicity is provided in Appendix H.

Table 8.
Whole Effluent Toxicity Test Results

(Fathead minnow LC50)

Reactor Effluent Number	LC50 (percent sample)		
	1/2/2004	1/8/2004	1/16/2004
1 - Control	>50	>50	>50
2 - NPBC-r	46.6 (37.6 – 57.8)	>50	
3 - NPBC-a	20.3 (17.0 – 24.2)	>50	>50
4 - NP2xC-r	>50	>50	
5 - NABC-r	>50	>50	
6 - FBC-r	>50	>50	
7 - FBC-a	>50	>50	
8 - NPBI-a	>50	>50	
9 - NP4xC-r	36.7 (33.9 – 39.9)	>50	
10 - NPBI-r	>50	>50	

EMPA and MPA removals throughout both phases of the study were fairly limited, although there tended to be some degradation of EMPA to form MPA. This can be seen in Table 9 for the reprocessed study period and in Table 10 for the comparison phase of actual and reformulated NCH. Note that the tables show EMPA normalized on the basis of the molecular weight of MPA. In general, the base loaded reactors resulted in a combined EMPA and MPA effluent concentration of approximately 40 mg/L, when expressed based on the molecular weight of MPA. As might be expected, the 4X loaded reactor averaged at or near four times this effluent concentration. Note that the control reactor with no NCH in the feed showed a positive value for EMPA in the feed and effluent (6-7 mg/L EMPA on average). This was a matrix interference caused by the wastewater composition. These background values should be subtracted out of the test reactor feed and effluent values. For example, the average value of 20 mg/L EMPA in the effluents from the peroxide treated DCC NCH at base loading (Reactors 2 and 3 in Table 9) should actually be 13 mg/L with the background subtracted.

Table 9.
EMPA and MPA Average Concentrations in Bioreactor Feeds and Effluents

Study Period with Reprocessed NCH (10/24/03 to 12/15/03)
(All values in mg/L)

		Influent				Effluent			
Reactor Number	Reactor Code	EMPA	EMPA norm'd to MPA	MPA	Total	EMPA	EMPA norm'd to MPA	MPA	Total
1	Control	6	5	0	5	7	6	0	6
2	NPSBC	49	38	10	48	21	17	28	44
3	NPBC	51	40	7	46	19	15	22	37
4	NPLC	25	19	4	23	13	10	10	20
5	NABC	49	38	6	44	23	18	21	39
6	FSBC	49	38	9	47	19	15	24	39
7	FBC	39	30	11	42	25	20	22	42
8	NPBI	51	40	7	46	27	21	21	42
9	NP4xC	172	133	23	156	46	36	107	143
10	NBC	52	41	6	47	26	20	23	43

Table 10.
EMPA and MPA Average Concentrations in Bioreactor Feeds and Effluents

Study Period wirh Actual vs Reprocessed NCH (12/19/03-1/8/04)
(All values in mg/L)

		Influent				Effluent			
Reactor Number	Reactor Code	EMPA	EMPA norm'd to MPA	MPA	Total	EMPA	EMPA norm'd to MPA	MPA	Total
1	Control	10	8	0	8	5	4	0	4
2	NPBC-r	56	43	4	47	46	35	12	47
3	NPBC-a	46	35	4	39	18	14	18	32
6	FBC-r	40	31	8	39	42	32	12	44
7	FBC-a	42	32	6	38	35	27	10	37
10	NPBI-r	48	37	4	41	40	31	14	44
8	NPBI-a	44	34	4	38	35	27	18	45

The treatability study has demonstrated the reduction of thiolamine and related compounds through the treatment process. As reported in the Pretreatment Results section, samples were submitted for GC-MS analyses (see Appendix E) and high levels of thiolamine were detected, as anticipated, in the untreated NCH. After the peroxide treatment, the thiolamine is destroyed and degrades into acetic acid, diisopropylamine, urea, and 2-diisopropylaminoethyl ethyl disulfide, represented by the green trace in Appendix E.

Since the oxidizing pretreatments were shown to destroy the thiolamine so that the compound would not be present in detectable amounts in the feed or effluents from those bioreactors receiving such pretreated NCH, only effluent from the bioreactor treating un-oxidized NCH (*i.e.*, Reactor 10 during the reprocessed NCH study period) was analyzed for thiolamine. No detectable thiolamine was found in the effluent from Reactor 10. It is clear from the blue curve, which tracks the baseline, that none of the thiolamine degradation products listed above are detectable in the biotreated effluent either. The bioreactor effluent hugs the baseline curve in Appendix E and is somewhat difficult to see, as there are no peaks in it other than that of the laboratory solvent used. The minimum detection limit for thiolamine was 5 ppm using GC/FID. This peak is also not visible in the bioreactor effluent.

Estimated mass balances for the EMPA, MPA and thiolamine are provided in the Conclusion section.

Appendix I provides all the operating data for the ten bioreactor study, including influent and effluent concentrations as well as reactor operating conditions.

Figure 11.

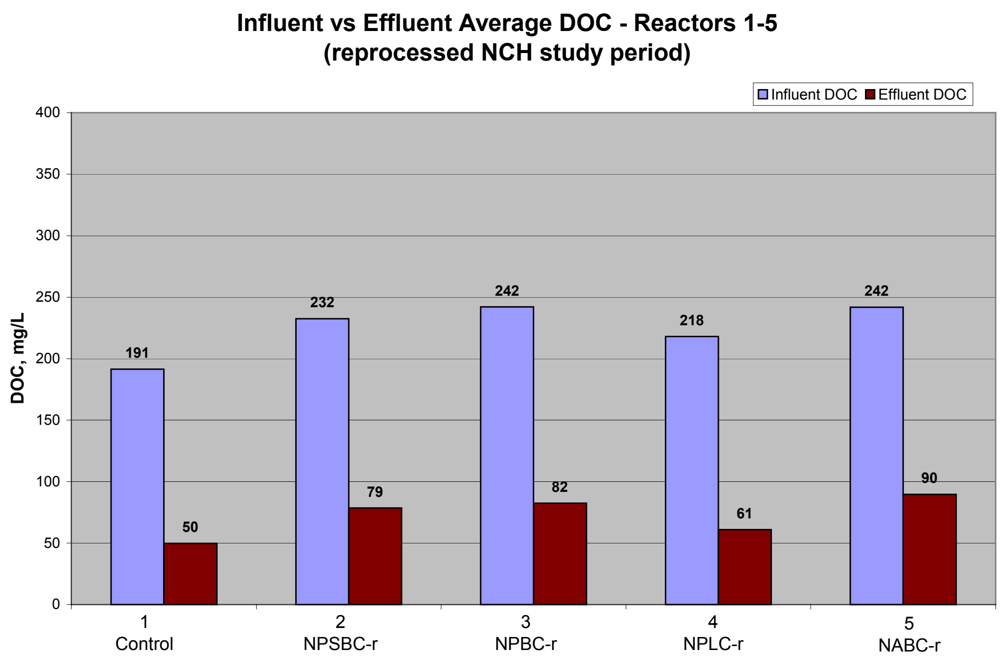
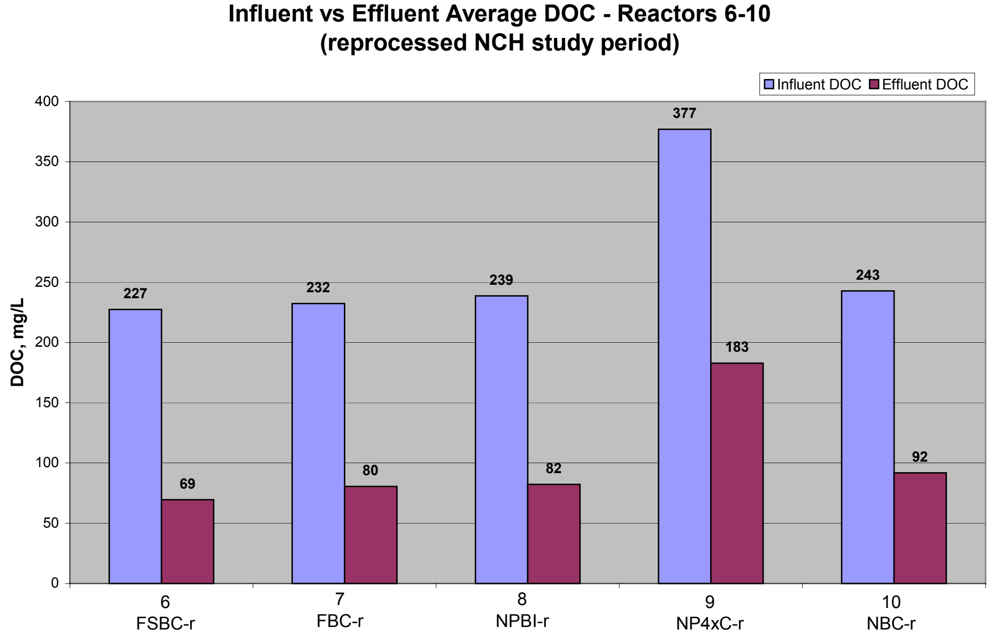


Figure 12.



Influent & Effluent Average DOC – Actual *vs.* Reprocessed NCH

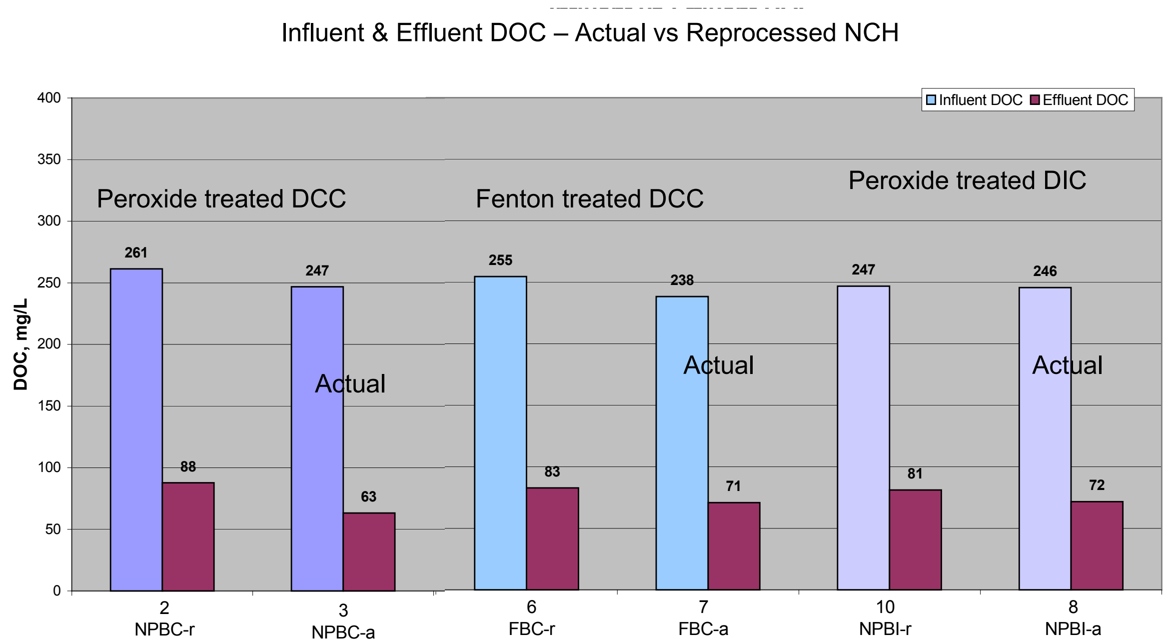


Figure 14.

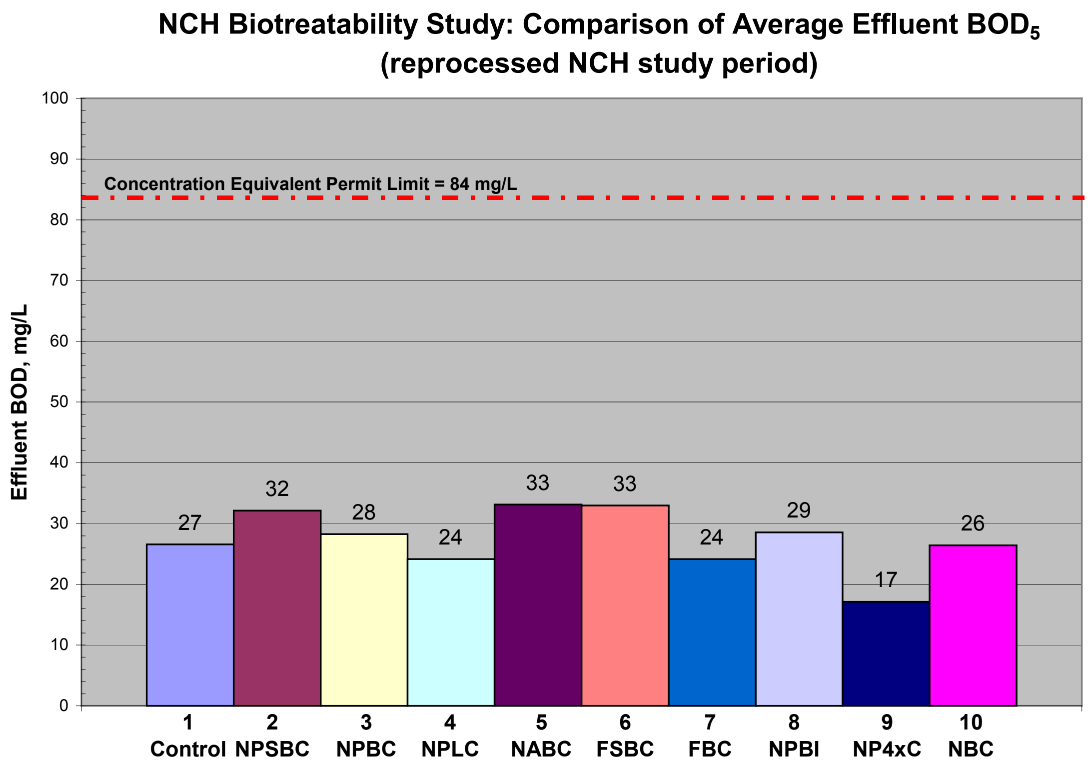


Figure 15.

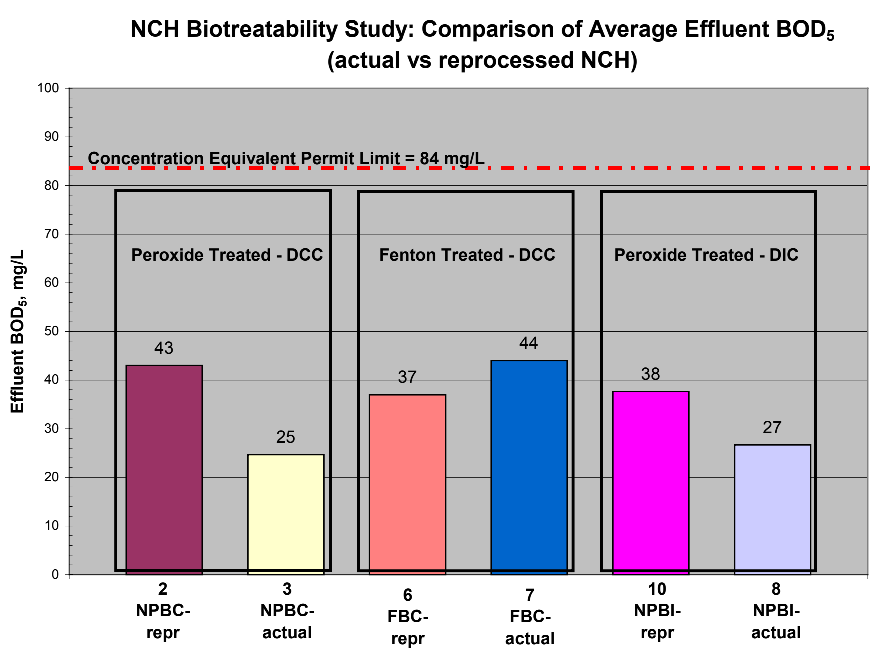


Figure 16.

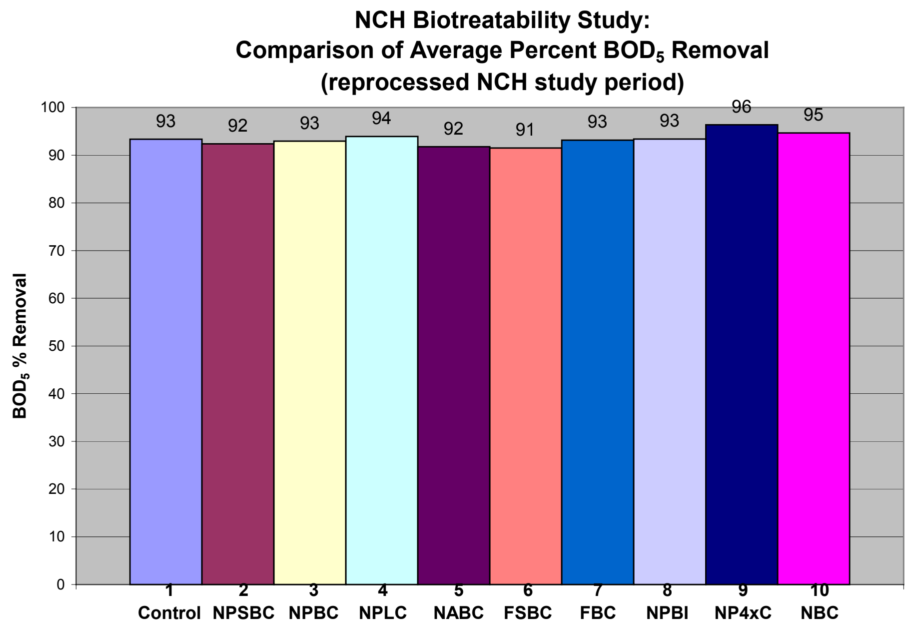


Figure 17.

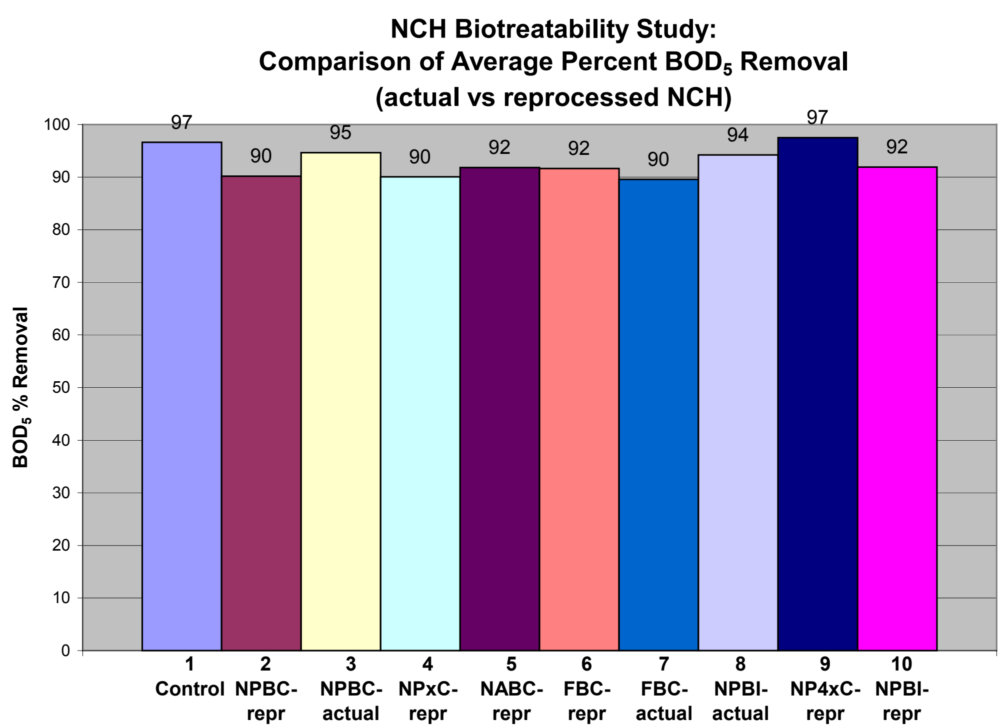


Figure 18.
NCH Biotreatability Study: Comparison of Average Effluent TSS (reprocessed NCH study period)

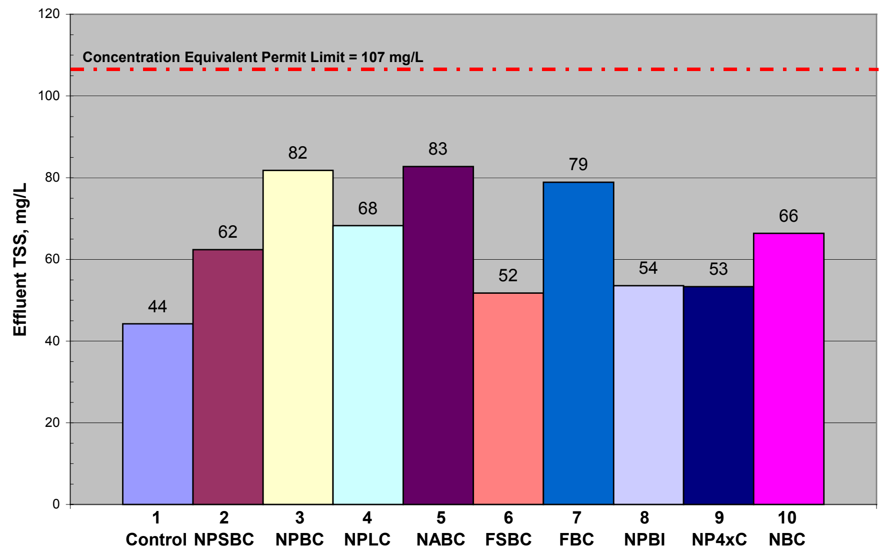
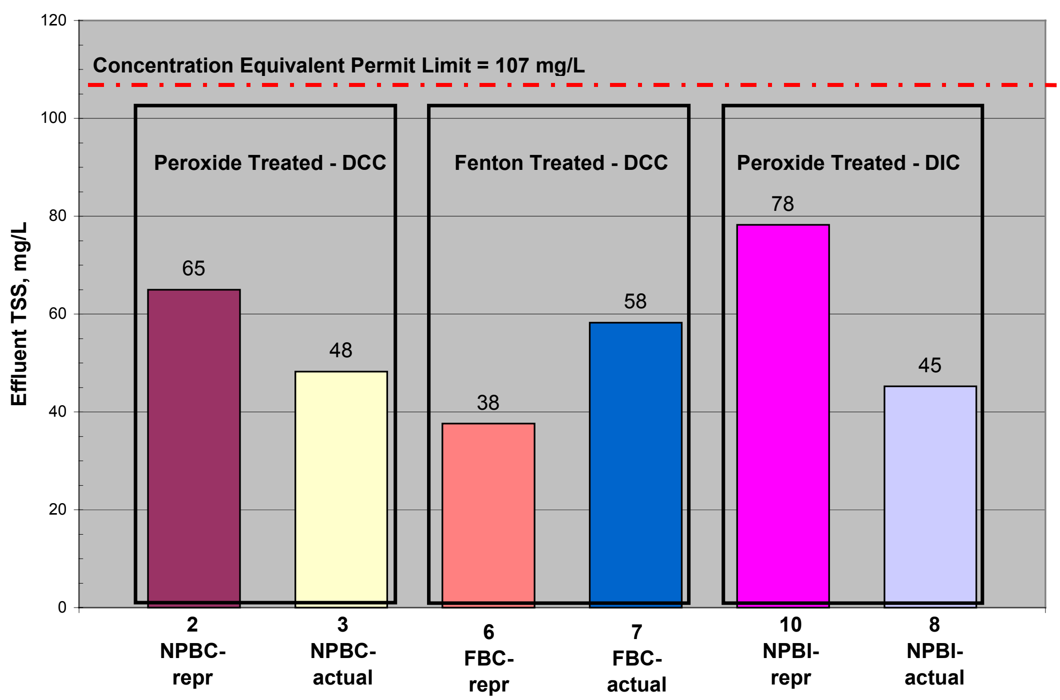


Figure 19.
NCH Biotreatability Study: Comparison of Average Effluent TSS (actual vs reprocessed NCH)



V. Odor Evaluation and Sludge Handling Characteristics

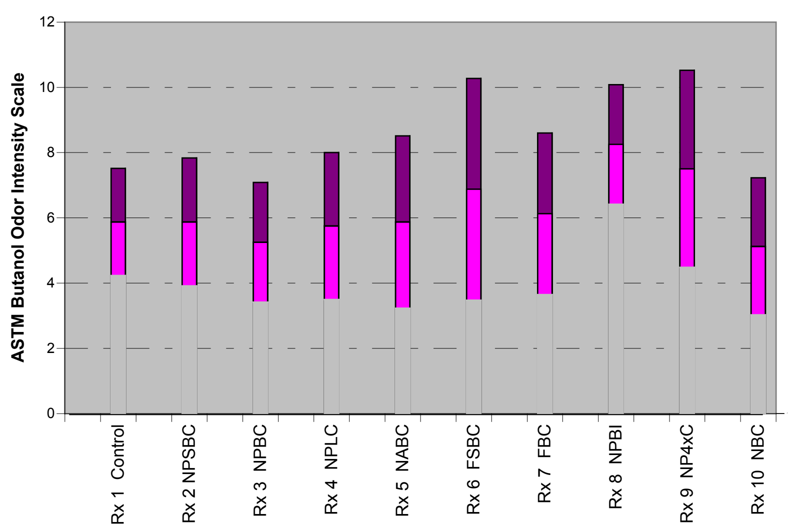
As described in the section on methods, the mixed liquors from all bioreactors were evaluated for odors twice: in the middle and at the end of the test program. Sludge cake odors were also evaluated at the end of the study. The odor panel demographic composition was very similar for all evaluations and six of the eight members of each of the panels were common to both.

Sludge cakes were prepared for the sludge odor evaluation using a belt press simulator. It was observed that there was no difference among the reactors in formation of a cake with good handling characteristics once the proper polymer recipe was found. All sludges received the same dosages and types of polymers, as described in the Methods section.

Figure 20 presents the results of the odor panel's evaluation of mixed liquors during the reprocessed NCH study period. The figure illustrates the average and the standard deviation for the panel.

Figure 20.

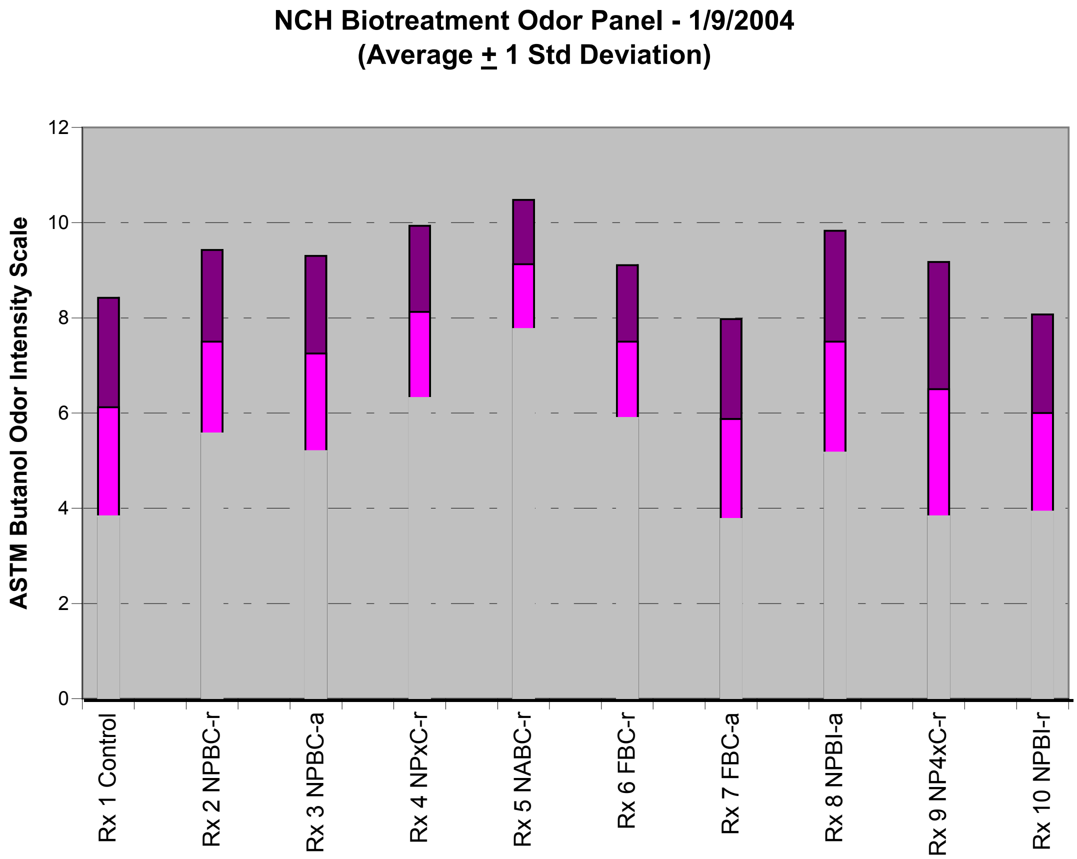
NCH Biotreatment Odor Panel Results - 12/11/03
(Average ± 1 std deviation)



These results show that there was no significant difference between the test reactors' odor intensities and that of the control reactor. Moreover, all odor intensities were well below the level considered to require further action for odor control. Interestingly, this includes Reactor 10, which received pH adjusted NCH with no chemical oxidation for odor control.

The results of the odor panel evaluation at the end of the study period for actual and reprocessed NCH are presented in Figure 21.

Figure 21.



These results confirm the earlier finding that there was no significant difference between the test reactors' odor intensities and that of the control reactor and that all odor intensities were well below the level considered to require further action for odor control. Most importantly in this phase of the study, the actual NCH presented no greater issue than the reprocessed material.

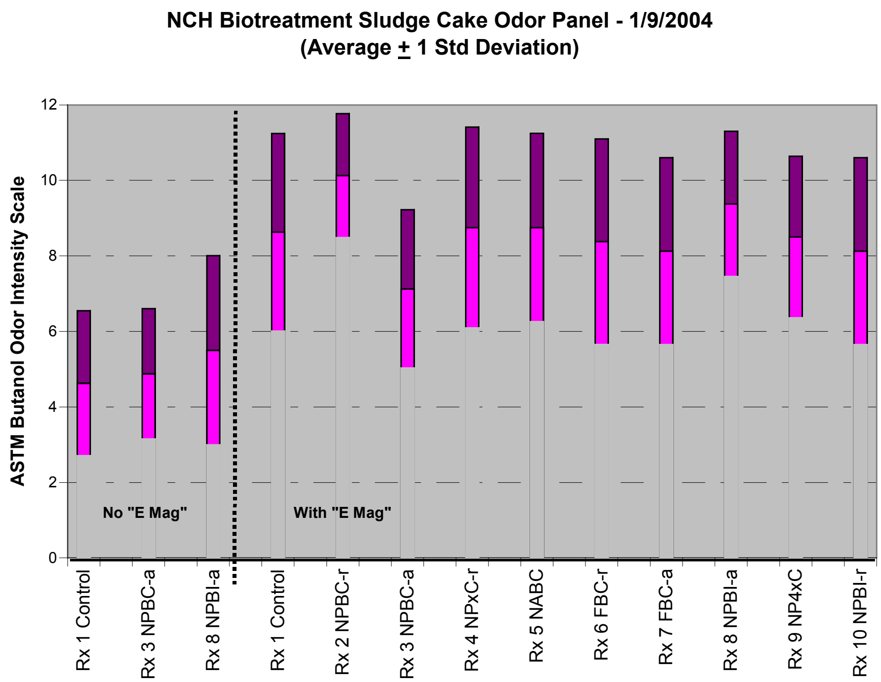
Finally, the odor panel's evaluations of the sludge cakes are presented in Figure 22. There are a number of points that are evident from this set of results. In particular:

- The sludge cakes from the peroxide-pretreated NCH – with either the DCC or the DIC stabilizer – showed no increase in odor intensity over the control cake among the cakes not treated with "Enviromag".

- None of the cakes treated with "Enviromag" showed any statistical difference in odor intensity compared with the control.

- The "Enviromag" treated sludges all exhibited more intense odors than the sludges without "Enviromag".

Figure 22.

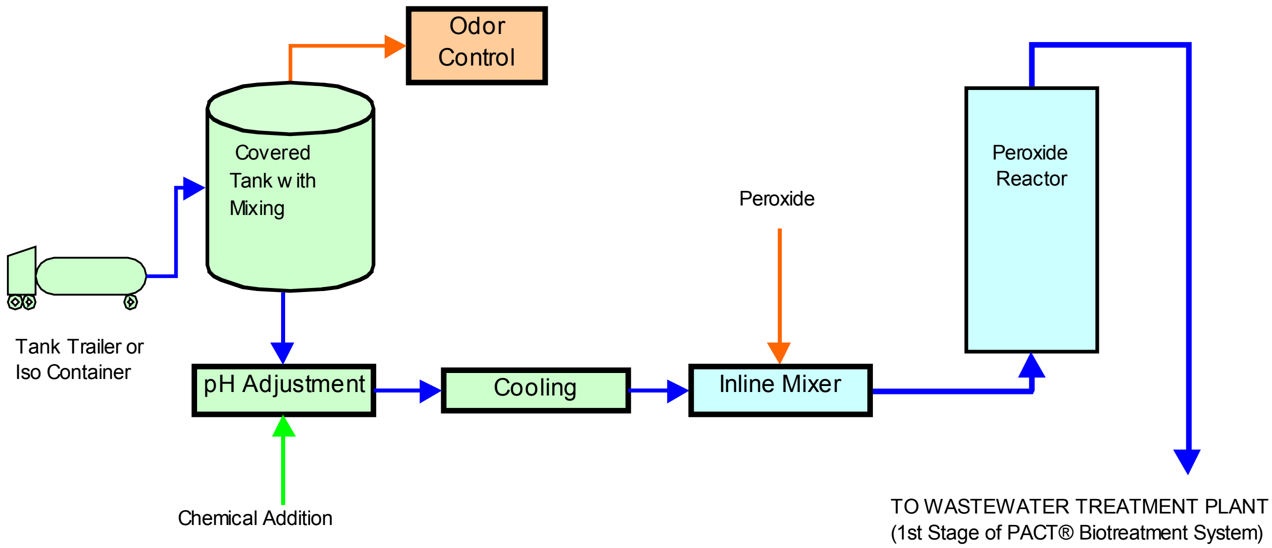


All odor panel results are provided in Appendix K. The appendix includes the statistical evaluations of the data, which show that there were no significant differences from the control values in any of the biotreatment or sludge odor panel assessments.

VII. NCH TREATMENT RECOMMENDATIONS

Based on the results and observations from this treatability study, a concept for pretreatment was developed. A receiving and hydrolysate storage system would be comprised of an unloading area for tank trucks or isocontainer transporting the NCH and a fully enclosed storage tank system with venting through an odor control system such as vapor-phase activated carbon. Hydrolysate would be pumped to a pH adjustment step with acid addition (*e.g.*, 20% sulfuric acid), a cooling step (if necessary to counteract the heat of neutralization) and a peroxide oxidation reactor. The hydrogen peroxide would be added through an in-line mixer. The peroxide reactor would be discharged directly to the first stage of the existing PACT® biotreatment system. Figure 23 illustrates the system schematically.

Figure 23.
Conceptual Diagram of Proposed Pretreatment System



VI. Conclusions

Based on the success criteria of this treatability study, the DuPont WWTP can effectively treat the stated volume (3000 to 7000 gpd) of hydrolysate generated at the Newport site.

The caustic NCH, as received, was observed to be odorous, but was no more severe than materials routinely handled at the SET WWTP. Any of the three chemical oxidation pretreatment methods tested – hydrogen peroxide, Oxone® and Fenton chemistry – when applied at the appropriate concentrations to destroy the odor causing thiolamine, result in odor control to enable management of the NCH in the SET WWTP.

Hydrogen peroxide was determined to be the preferred pretreatment chemical from the standpoint of effectiveness and process safety management. A dosage of 2 wt% H_2O_2 applied to 16% NCH was demonstrated to be effective in odor control, thiolamine destruction and enhancement of biotreatability (*e.g.*, through formation of biodegradable breakdown products of thiolamine).

On a weight percent basis, a substantially higher Oxone® dosage was found to be necessary to attain the same odor control as hydrogen peroxide and yielded no additional reduction of EMPA, MPA or thiolamine. No improvements in biotreatability were evident with Oxone®.

Although there was evidence that Fenton chemistry increased transformation of EMPA to MPA, Fenton reagent yielded minimal increase in the reduction of total EMPA and MPA as compared with peroxide alone.

The bioreactor study demonstrated treatment at a equivalent feed rate 5000 gpd (16%) of both DCC and DIC stabilized NCH with all three oxidation protocols. Hydrolysate at lower concentrations could be fed at proportionately higher rates; e.g., 8% NCH could be fed at double the rate shown for 16% NCH. At the conclusion of the study, the bioreactor system was operating within normal operating conditions at an equivalent NCH (16%) feed rate of 10,000 gallons per day with the preferred pretreatment method (hydrogen peroxide oxidation).

Chemical oxidation pretreatment will reduce the thiolamine content of the NCH below detection, but has limited effect on the EMPA and MPA. Biotreatment will convert a substantial fraction of EMPA to MPA. Concentrations of EMPA and MPA will be reduced to a total of approximately 27 and 28 mg/L, respectively, through the SET WWTP and 10 and 11 mg/L, respectively, in the plant effluent at the base loading rate. No other organic components or degradation products of the NCH that were identified in GC-MS scans of the raw or pretreated NCH were found in the bioreactor effluent. Table 11 is an estimate of the fate of EMPA, MPA and thiolamine through the treatment system based on results of the pretreatment studies, biotreatment studies, WWTP flow of 10 million gpd and outfall flow of 26 million gpd – the lowest monthly flows experienced in the most recent year – for conservatism.

Table 11.
Estimated Fate of NCH Compounds through WWTP[16]

	16% NCH	Pretreatment Effluent[a]	Biotreatment Feed	Secondary Treatment Effluent	Plant Effluent (001 spot)[c]	Atmosphere[17]	Sludge
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/m3	mg/kg
EMPA	70,000	30,000	62[b]	27[b]	10	0	20
MPA	7,200	4,500	8	28	11	0	20
Thiol-amine	65,000	<12	0	0	0	0	0
Flow	7,000 gpd	14,000 gpd	10 MGD	10 MGD	26 MGD		
	[a] Including dilution in pretreatment process		[b] Subtracts matrix back-ground found in control		[c] assumes no additional removal in tertiary PACT® treatment system		

A related study on the environmental effects of EMPA and MPA will be issued at about the same time as this treatability study report. The report, entitled "Screening Level Ecological Risk Assessment for Discharge of Effluent from the Treatment of Newport (Indiana) Caustic Hydrolysate" (Hoke, *et al.*, 2004), shows that the levels of EMPA and MPA described above will have no aquatic toxicological impact. For example, the chronic risk characterization for MPA was based on chronic No Observable Effect Concentration (NOEC) values from the studies using *Ceriodaphnia dubia* (a sensitive freshwater invertebrate), *Americamysis bahia* (mysid shrimp, a sensitive marine invertebrate), *and Cyprinodon variegates* (sheepshead minnow, a sensitive marine vertebrate). These NOEC values range from 87 mg/L for *Ceriodaphnia* to 800 mg/L for mysid shrimp and over 1000 mg/Lfor sheepshead minnow, compared with EMPA and MPA concentrations each below 1 mg/L, after mixing in the receiving stream.

[16] Based on base NCH loading rate in study (equivalent to 7000 gpd NCH@16%)
WWTP Flow = 10 million gpd (lowest monthly average, 2003)
Outfall 001 flow = 26 million gpd (lowest monthly average, 2003)
Sludge generated at 27% solids

[17] See Appendix I for physical properties calculation basis for air emissions

The foregoing results and observations achieved the three major success criteria of the study – odor control, operational stability and permit compliance. All three aspects were demonstrated conclusively through this study.

APPENDICES

Appendix A.
Characterization of NCH Samples

Date Rec'd	Description	pH SU	Sp.G. kg/L	DOC mg/L	TOC mg/L	COD,t mg/L	COD,s mg/L	BOD5,s mg/L
9/11/2003	16% NCH, reprocessed, DCC	12.6	1.101	78,360	72,406	156,400	181,600	*
9/11/2003	16% NCH, reprocessed, DIC	12.9	1.105	72,340	75,558	158,400	174,400	1,325
9/18/2003	16% NCH, reprocessed, DCC	13			85,307	187,000	108,500	not analyzed
9/23/2003	16% NCH, reprocessed, DIC	13				192,500	166,000	not analyzed
10/30/2003	8% NCH, actual (“fresh”), DIC	13.1	1.092	49,680	44,147	99,500	43,500	not analyzed
12/3/2003	8% NCH, actual (“fresh”), DCC	12.5	1.107	47,460	46,443	106,500	55,000	not analyzed
12/22/2003	16% NCH, actual (“fresh”), DIC	13.0	1.058	92,400	87,606	231,000	99,500	not analyzed
Average (all samples normalized to 16% NCH)		12.9	1.093	87,476	83,676	191,043	132,429	N/A
Std Deviation (normalized to 16% NCH)		0.23	0.020	11,544	7,965	27,161	39,854	N/A

Date Rec'd	Description	Total N mg/L	Total S mg/L	Total P mg/L	EMPA mg/L	MPA mg/L	Thiolamine mg/L
9/11/2003	16% NCH, reprocessed, DCC	9,010		23,400	72,891	7,672	
9/11/2003	16% NCH, reprocessed, DIC	9,684		20,200	66,779	6,819	
9/18/2003	16% NCH, reprocessed, DCC	9,323	18,700	19,800	64,896	8,904	50,600
9/23/2003	16% NCH, reprocessed, DIC						
10/30/2003	8% NCH, actual (“fresh”), DIC	4,334	8,107	10,900	35,937	2,826	42,900
12/3/2003	8% NCH, actual (“fresh”), DCC	4,639	7,630	10,400	33,656	3,764	
12/22/2003	16% NCH, actual (“fresh”), DIC	9,970	15,660	21,900	78,817	6,782	
Average (all samples normalized to 16% NCH)		9,322	16,459	21,317	70,428	7,226	68,200
Std Deviation (normalized to 16% NCH)		464	1,545	1,321	5,141	1,091	24,890

Date Rec'd	Description	TSS mg/L	VSS mg/L	TDS mg/L	Conductivity umhos/cm	NH3-N by distill	NH3-N direct
9/11/2003	16% NCH, reprocessed, DCC	903	769			6,350	171
9/11/2003	16% NCH, reprocessed, DIC	1,307	1,168	123,960		6,373	12
9/18/2003	16% NCH, reprocessed, DCC	221	181		427,000		
9/23/2003	16% NCH, reprocessed, DIC						
10/30/2003	8% NCH, actual (“fresh”), DIC	606	584		325,000		
12/3/2003	8% NCH, actual (“fresh”), DCC	578	560		325,000		
12/22/2003	16% NCH, actual (“fresh”), DIC	505	456		499,500		
Average (all samples normalized to 16% NCH)		884	810	41,320	394,125	6,362	92
Std Deviation (normalized to 16% NCH)		435	418	71,568	85,130	16	112

Date Rec'd	Description	TKN mg/L	NO2-N mg/L	NO3-N mg/L	PO4-P mg/L	Cl mg/L
9/11/2003	16% NCH, reprocessed, DCC	7,454	<200	<100	<200	<500
9/11/2003	16% NCH, reprocessed, DIC	8,114	<200	<100	<200	<500
9/18/2003	16% NCH, reprocessed, DCC					
9/23/2003	16% NCH, reprocessed, DIC					
10/30/2003	8% NCH, actual (“fresh”), DIC					
12/3/2003	8% NCH, actual (“fresh”), DCC					
12/22/2003	16% NCH, actual (“fresh”), DIC					
Average (all samples normalized to 16% NCH)		7,784	<200	<100	<200	<500
Std Deviation (normalized to 16% NCH)		467	N/A	N/A	N/A	N/A

Shaded areas indicate analysis at DuPont SET laboratories in Deepwater, NJ. Remainder of analyses performed at DuPont Experimental Station laboratories near Wilmington, DE.

Some difficulty was encountered in the analysis of soluble (*i.e.*, filtered) and total COD. In a number of samples the soluble COD value exceeded the total. The overall averages are sensible.

The lower TOC values than DOC may be attributable to using instruments from different laboratories. The differences are relatively insignificant.

NH3-N results by distillation method yielded significantly excessive results due to carryover of amines in the distillation. The direct analysis of NH3-N is a better procedure where substantial amines are present.

Appendix B.
Preliminary Waste Characterization Sheet
DuPont Secure Environmental Treatment

D# D24076
T024076

PRELIMINARY
Waste Characterization
Profile Sheet

(A) GENERATOR INFORMATION

Generator U.S. Army NECDF
USEPA I.D. No IN1210022272
Site Loc Highway 63 South
Newport IN 47966

Submitter Parsons
Mail Address P.O. Box 519
Newport IN 47966

Contact Ph. Fax

Contact Ph. Fax

(C) GENERAL WASTE INFORMATION

Name of Waste Newport Caustic Hydrolysate
Process Generating Waste
Wastewater from chemical agent destruction facility
In Newport, Indiana.

(B) SPECIFIED TREATMENT

X Water Treatment
__Organic Recovery
__Oil/Water
__Other ____________

(F) EXPECTED VOLUME

	Gal	Drum
Annual	1000000	X
Per Shipment	4000	X

(J) METHOD OF SHIPMENT

TANK TRUCK

(D) WASTE STREAM COMPOSITION

Major Components	Concentration Range (wt % or ppm) Lower	Upper	Typical
SODIUM-2-(DIISOPROPYLAMINO)ETHYLTHIOLATE		<11%	
SODIUM ETHYLMETHYL PHOSPHONATE		<8%	
SODIUM HYDROXIDE		<4%	
SODIUM METHYL PHOSPHONATE		<1%	
OTHER COMPONENTS (INCLUDING ETHANOL, 2-(DIISOPROPYLAMINO)ETHYL DISULFIDE, DIISOPROPYLAMINE)		<1%	
WATER		BALANCE	

(E) EPA INFORMATION RCRA HAZARDOUS WASTE CODES
(and/or State Codes)
D002

(I) PHYSICAL PROPERTIES

	Explosive	X Multiple liquid phases	Oxidizer	Infectious
X	Water miscible	Carcinogen (or suspect)	Radioactive	Emulsion

pH Range	12.50 to 14.00	Total Suspended Solids (TSS) (%)	< 1.0
Odor	Y	Color/Appearance	YELLOW
Flash Point (*F)	> 200	Temperature (as delivered) (*F)	AMB.
Dissolved Organic Carbon (DOC) (%)	< 10.0	Reaction products with acidic water	Y
Total Organic Carbon (TOC) (%)	< 10.0		

GENERATOR CERTIFICATION STATEMENT:

I hereby certify that I am authorized to sign this form on behalf of the Wastewater Generator identified, and that I have personally examined and am familiar with the information submitted in this and all attached pages. Based on my inquiry of those individuals immediately responsible for obtaining the information, the submitted information is true, accurate, and complete and all known and suspected hazards have been disclosed.

Generator Signature ____________ Title ____________ Date ____________

DuPont Secure Environmental Treatment

D# D24076

T024076

PRELIMINARY
Waste Characterization
Profile Sheet

(N/A = nil)

(K) SPECIFICATIONS

Characteristic Metals	TCLP (PPM)	Total Comp (PPM)
Arsenic	<1	<1
Barium	<1	<1
Cadmium	N/A	N/A
Chromium	<1	<1
Lead	<1	<1
Mercury	<0.01	<0.01
Selenium	<1	<1
Silver	N/A	N/A
Other Metals		
Antimony		N/A
Chrome +6		N/A
Copper		<1
Iron		<5
Nickel		N/A
Thallium		N/A
Zinc		<10
Other Components		
Ammonia		<500
Cyanides		
- soluble		N/A
- total		N/A
- amenable		N/A
Fluoride		N/A
Mercaptans		N/A
PCB's		N/A
Sulfides		
- soluble		<100
- total		N/A
Total organic halogens		N/A

TC Organics	TCLP (PPM)	Total Comp (PPM)
Benzene	N/A	N/A
Carbon tetrachloride	N/A	N/A
Chlordane	N/A	N/A
Chlorobenzene	N/A	N/A
Chloroform	N/A	N/A
Cresols	N/A	N/A
1,4-Dichlorobenzene	N/A	N/A
1,2-Dichloroethane	N/A	N/A
1,1-Dichloroethylene	N/A	N/A
2,4-Dinitrotoluene	N/A	N/A
Heptachlor	N/A	N/A
Hexachlorobenzene	N/A	N/A
Hexachlorobutadiene	N/A	N/A
Hexachloroethane	N/A	N/A
Methyl ethyl ketone	N/A	N/A
Nitrobenzene	N/A	N/A
Pentachlorophenol	N/A	N/A
Pyridine	N/A	N/A
Tetrachloroethylene	N/A	N/A
Trichloroethylene	N/A	N/A
2,4,5-Trichlorophenol	N/A	N/A
2,4,6-Trichlorophenol	N/A	N/A
Vinyl chloride	N/A	N/A
Non-TC Organics		
Anthracene		N/A
Bis (2-ethylhexyl) phthalate		N/A
Butyl benzyl phthalate		N/A
Chloroethane		N/A
2-Chlorophenol		N/A
Cyclohexadiene		N/A
1,2-Dichlorobenzene		N/A
2,4-Dichlorophenol		N/A
Dicyclopentadiene		N/A

Non-TC Organics	Total Comp (PPM)
N-N-Dimethylaniline	N/A
Dimethyl hydrazine	N/A
2,4-Dimethylphenol	N/A
4,6 Dinitro-o-cresol	N/A
2,4-Dinitrophenol	N/A
Di-n-butyl phthalate	N/A
2,6-Dinitrotoluene	N/A
Di-n-octal phthalate	N/A
Epichlorohydrin	N/A
Ethylene oxide	N/A
Fluorene	N/A
Furfuryl alcohol	N/A
Isophorone	N/A
Methylacetylene	N/A
Methyl chloride	N/A
Methylene chloride	N/A
Monomethyl aniline	N/A
Monomethyl hydrazine	N/A
Naphthalene	N/A
2-Nitrophenol	N/A
4-Nitrophenol	N/A
1,1-Oxybis butane	N/A
Phenanthrene	N/A
Phenol	N/A
Propylene oxide	N/A
Pyrene	N/A
Styrene	N/A
Tetramethyl lead	N/A
Toluene	N/A
Toluene diisocyanate	N/A
1,2,4-Trichlorobenzene	N/A
1,1,1-Trichloroethane	N/A
1,1,2-Trichloroethane	N/A
Xylene	N/A

(L) ADDITIONAL SPECIFICATIONS

Cannot accept waste with requirements for Benzene or OSWRO (Off Site Waste and Recovery Operations) NESHAP Controls or HON Group 1 Controls. An LDR form is required with each shipment that was hazardous "As Generated" but has been rendered Non-Hazardous by treatment. All waste must be flowable, and all truck and rail cars must be bottom-unloading.

Approved By

DuPont Environmental Treatment Signature

Date

Appendix C
Titration Curves

DCC sample # 2930-5 **Start volume 50ml**
Clear yellow with clear dark yellow layer on top
1:1 DCC sample
20% H2SO4 used to titrate

mL 20% H2SO4	pH	Temp	
0	13.54	23.6	
0.5	13.60		
1	13.58	27.9	
1.5	13.56	27.9	
2.5	13.49	29.8	
3.5	13.39	31.5	
4.5	13.24	33	Cloudy
5.5	12.98	34.3	
6.5	12.64	35.1	
7.5	12.22	35.6	
8.5	11.36	36.1	
9.5	7.71	36.6	Clearing
10	7.36	36.8	
10.5	7.15	37.2	
11	6.98	37.4	
11.5	6.83	37.7	
12	6.69	37.7	
12.5	6.61	37.7	long time to stabilize
13	6.46	36.9	
13.5	6.28	36.8	
14	6.03	36.2	
14.5	5.96		
15	5.78	34.3	
15.5	3.45	33.6	
16	2.99	33.3	quicker to stabilize
16.5	2.73	33.1	
17	2.54	32.3	
17.5	2.39	32.6	
18	2.26	32.5	
18.5	2.16	32.3	
19	2.06	32.1	

Trial 2, same conditions

mL 20% H2SO4	pH	Temp
0.0	13.20	16.9
1.0	13.23	18.8
2.0	13.19	21.1
3.0	13.14	23.3
4.0	13.08	25.3
5.0	13.01	27.2
6.0	12.75	28.4
7.0	12.41	29.5
8.0	11.89	30.4
9.0	8.86	31.2
9.5	7.72	31.7
10.0	7.41	32.2
10.5	7.22	32.8
11.0	7.08	33.4
11.5	6.94	34.0
12.0	6.83	34.6
12.5	6.73	35.1
13.0	6.62	35.5
13.5	6.52	36.0
14.0	6.41	36.4
14.5	6.31	36.8
15.0	6.19	36.7
15.5	6.03	36.7
16.0	4.09	36.5
16.5	3.24	35.8
17.0	2.93	35.4
17.5	2.72	35.1
18.0	2.56	34.8
18.5	2.43	34.6
19.5	2.22	34.2

DIC sample # 2932-3 **Start volume 50ml**
Clear yellow with clear faint yellow layer on top
1:1 DIC
20% H2SO4 used to titrate

mL 20% H2SO4	pH	Temp	
0.0	12.85	22.7	
1.0	12.88	24.1	
2.0	12.90	25.2	
3.0	12.91	27.2	
4.0	12.92	29.0	
5.0	12.89	30.8	
6.0	12.85	32.0	
7.0	12.70	34.5	
8.0	12.40	35.7	
9.0	11.98	36.4	milky coloration
10.0	10.52	36.7	
11.0	7.50	37.0	
11.5	7.19	37.3	
12.0	6.98	37.6	
12.5	6.80	37.8	
13.0	6.64	38.1	
13.5	6.52	38.3	
14.0	6.38	38.0	
14.5	6.05	37.4	
15.0	3.50	37.2	
15.5	3.02	36.9	
16.0	2.76	36.7	
16.5	2.57	36.5	
17.0	2.42	36.2	

Trial 2, same conditions

mL 20% H2SO4	pH	Temp
0.00	13.02	22.70
1.00	13.04	24.90
2.0	13.04	27.0
3.0	13.03	28.9
4.0	13.00	30.8
5.0	12.99	32.5
6.0	12.90	34.0
7.0	12.72	35.5
8.0	12.38	36.6
9.0	11.91	37.4
9.5	11.51	37.2
10.0	9.99	37.5
10.5	7.86	37.7
11.0	7.36	38.0
11.5	7.09	38.4
12.0	6.89	38.6
12.5	6.72	38.7
13.0	6.57	38.7
13.5	6.43	38.8
14.0	6.21	38.6
14.5	4.35	38.3
15.0	3.22	37.5
15.5	2.88	37.2
16.0	2.65	37.0
16.5	2.48	36.7

Appendix D.
Ion Chromatograph Method
DuPont Engineering Wastewater Laboratory
Experimental Station E262

Description

The following method is used in the determination of several ionic species in wastewater and NCH Hydrolysate samples including: fluoride, acetate, propionate, formate, fluoride, chloride, nitrite, nitrate, sulfate, phosphate, methylphosphonate, and ethylmethylphosphonate.

IC METHOD NAME: ANIONS11.MET

INSTRUMENT

Dionex DX 500 Ion Chromatograph with GP 40 gradient pump, CD 20 conductivity detector, EG 40 eluent generator, LC 30 chromatography oven, and AS 3500 autosampler.

COLUMNS

Dionex IonPac AS11 analytical, AG11 guard (4-mm), ATC-1 anion trap columns; samples prepared with Dionex OnGuard RP columns.

SAMPLE VOLUME

50 microliters

SUPPRESSOR:

Anion self-regenerating suppressor-ULTRA (4-mm) operated in autosuppression recycle mode (100 ma).

OVEN TEMPERATURE

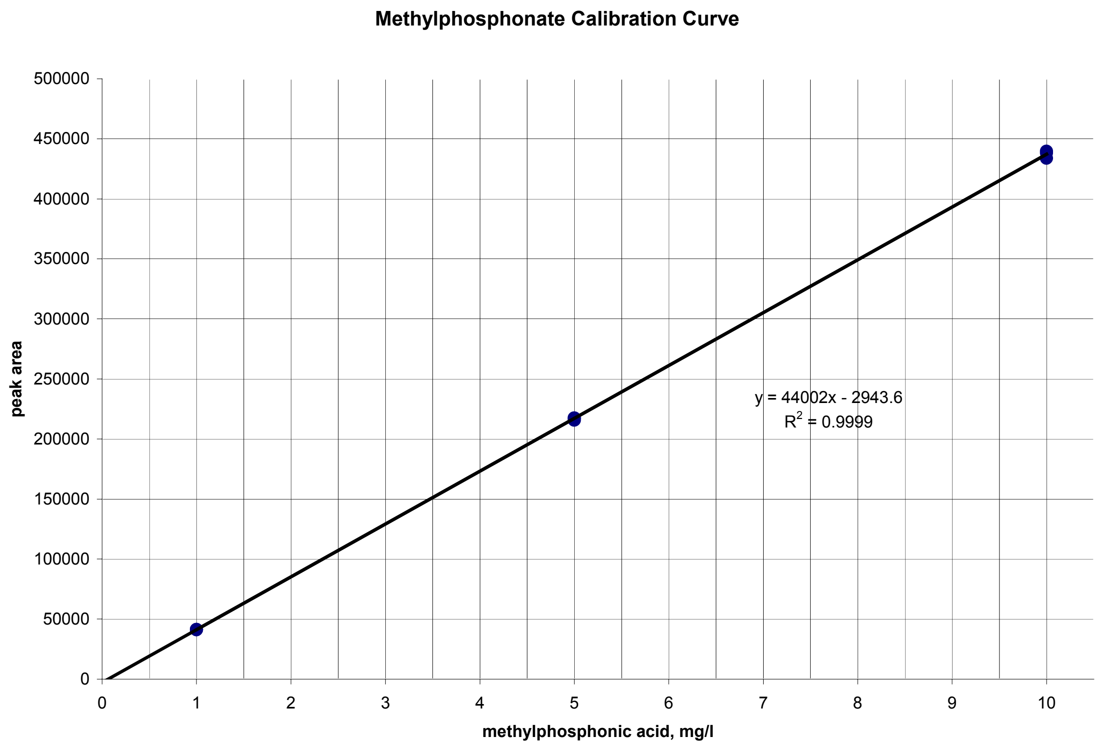
30 C

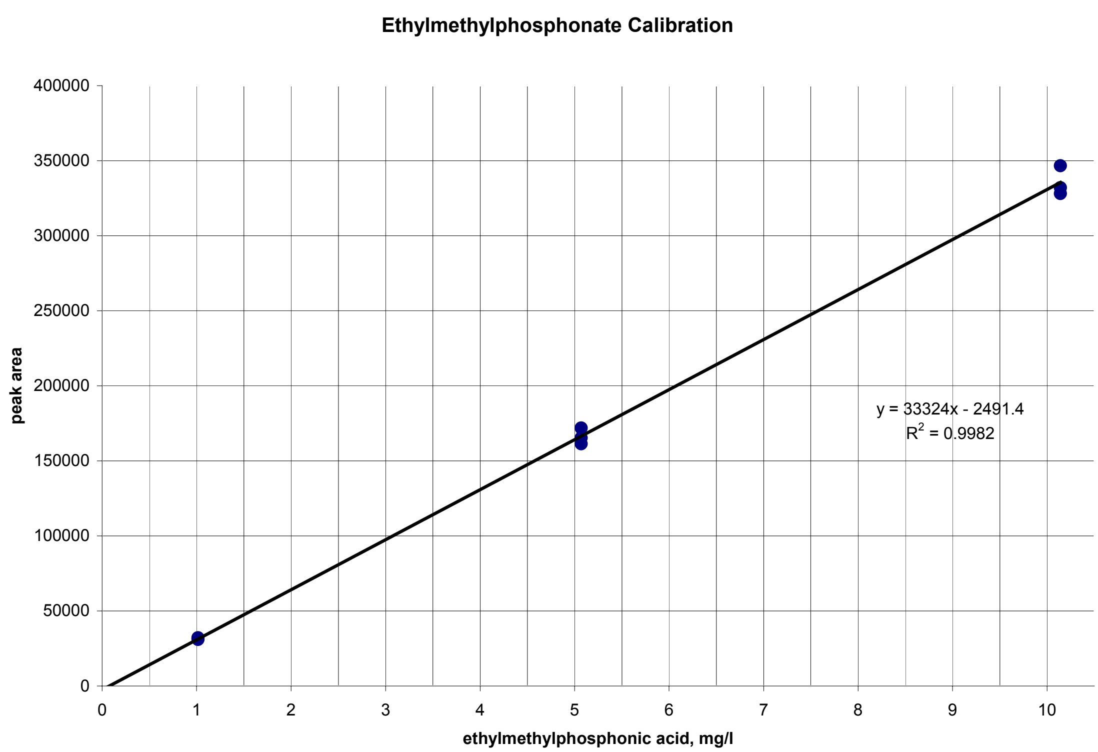
ELUENT FLOW RATE

2 ml/min

ELUENT CONDITIONS

0 min:	0.5 mM KOH
2 min:	0.5mM to 5 mM KOH in 3 min
5 min:	5 mM to 15 mM KOH in 10 min.
15.1 to 18 min:	0.5 mM KOH


Methylphosphonate Calibration Curve
peak area
500000
450000
400000
350000
300000
250000
200000
150000
100000
50000
0
0
1
2
3
4
5
6
7
8
9
10
methylphosphonic acid, mg/l
y = 44002x - 2943.6
R^2 = 0.9999


Ethylmethylphosphonate Calibration
peak area
400000
350000
300000
250000
200000
150000
100000
50000
0
0
1
2
3
4
5
6
7
8
9
10
ethylmethylphosphonic acid, mg/l
y = 33324x - 2491.4
R^2 = 0.9982

February 2304 IC Quality Control Data
Analysis of MPA and EMPA Check Standards

			****** mg/l ******	
Date / Time	DF	Sample	EMPA	MPA
2/2/2004 13:01	1	10 ppm MPA		10.02
2/2/2004 17:25	1	10 ppm MPA		10.13
2/2/2004 18:04	1	5 ppm EMPA	5.01	
2/2/2004 18:24	1	10 ppm EMPA	9.87	0.12
2/2/2004 21:01	1	5 ppm EMPA	5.05	
2/2/2004 21:21	1	10 ppm EMPA	10.07	0.12
2/5/2004 13:27	1	10 ppm MPA		9.93
2/5/2004 17:42	1	10 ppm MPA		10.12

Appendix E:
Thiolamine Analytical Procedure and Results

QUANTITATIVE ANALYSIS OF THIOLAMINE DEGRADATION

Calibration Standard Preparation

A 480-ppm stock solution is prepared by weighing 25 mg of 96% pure Thiolamine standard and diluting to 50 mL using pH-adjusted water (pH ~6.5). A series of calibration standards are prepared according to the following:

vial #	vol. of stock soln. (µL)	vol. of pH-adj. water (µL)	Thiolamine conc. (ppm)
1	0	1000	0
2	25	975	12
3	100	900	48
4	250	750	120
5	500	500	240
6	750	250	360
7	1000	0	480

Sample Preparation

Untreated Thiolamine Solution

Pipet 5 L of untreated Thiolamine into a GC vial and dilute to 1 mL with pH-adjusted water.

Peroxide Treated Sample

The peroxide-treated sample was analyzed neat.

Instrument Parameters

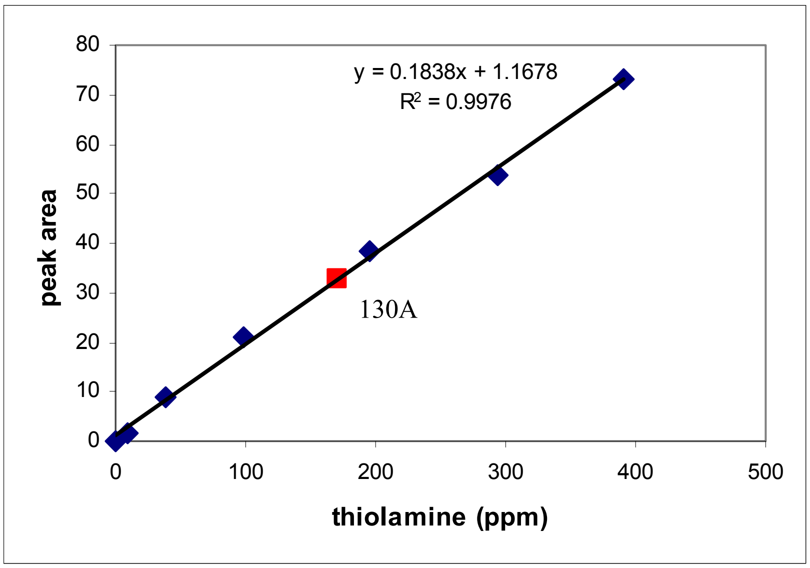
The samples are quantified using a GC-FID instrument with the following operating conditions:

Detector	Flame ionization Hydrogen: 40.0 mL/min Air: 450.0 mL/min
Split Ratio	50:1
Injection Temperature	100°C
Detector Temperature	325°C
Initial Column Temperature	40°C
Pre-Program Hold	0 min
Temperature Rise	5°C/min to 190°C

Post-Program Hold	0 min
Working Column	30.0 m x 0.25 mm I.D. fused silica coated with 1.00 µm film thickness, 5% phenyl methyl siloxane bonded stationary phase

Results

The calibration standards yielded the following curve:



The "untreated" sample (E105189-130A; data point shown in red, above, after 200:1 dilution) was calculated to be 3.4% in the original sample based on this calibration curve. This sample was comprised of 50.0 g of actual 8% DIC NCH (MT-3-DICDI-4A) pH adjusted with 13.12 g of 20% H_2SO_4. Therefore, a mass balance calculation shows that the raw 8% DIC NCH sample was 4.29% thiolamine [3.4% x (50.0+13.12)/50.0].

The peroxide-treated sample (E105189-130B) was less than our lowest standard (<12 ppm).

A summary of peroxide treated samples showed the following thiolamine results (note that the final result is a Fenton's reagent treatment):

Sample Designation	Date Rec'd	Description	Amount NCH gms	Amount 20% H_2SO_4 gms	Amount $Fe_2(SO_4)_3$ gms	Amount 10% H_2O_2 gms	Thiolamine ppm
E105189-128	10/30/2004	8% DIC (fresh)	322.95	82.6	0	48.2	<12
E105189-130	10/30/2004	8% DIC (fresh)	25.00	6.6	0	4.75	<12
E105189-127	12/3/2004	8% DCC (fresh)	320.20	76.2	0	48.0	22.5

QUALITATIVE ANALYSIS OF THIOLAMINE DEGRADATION PRODUCTS

SAMPLE PREPARATION

Untreated Thiolamine Solution

Pipet 5 µL of untreated Thiolamine into a GC vial and dilute to 1 mL with pH-adjusted water.

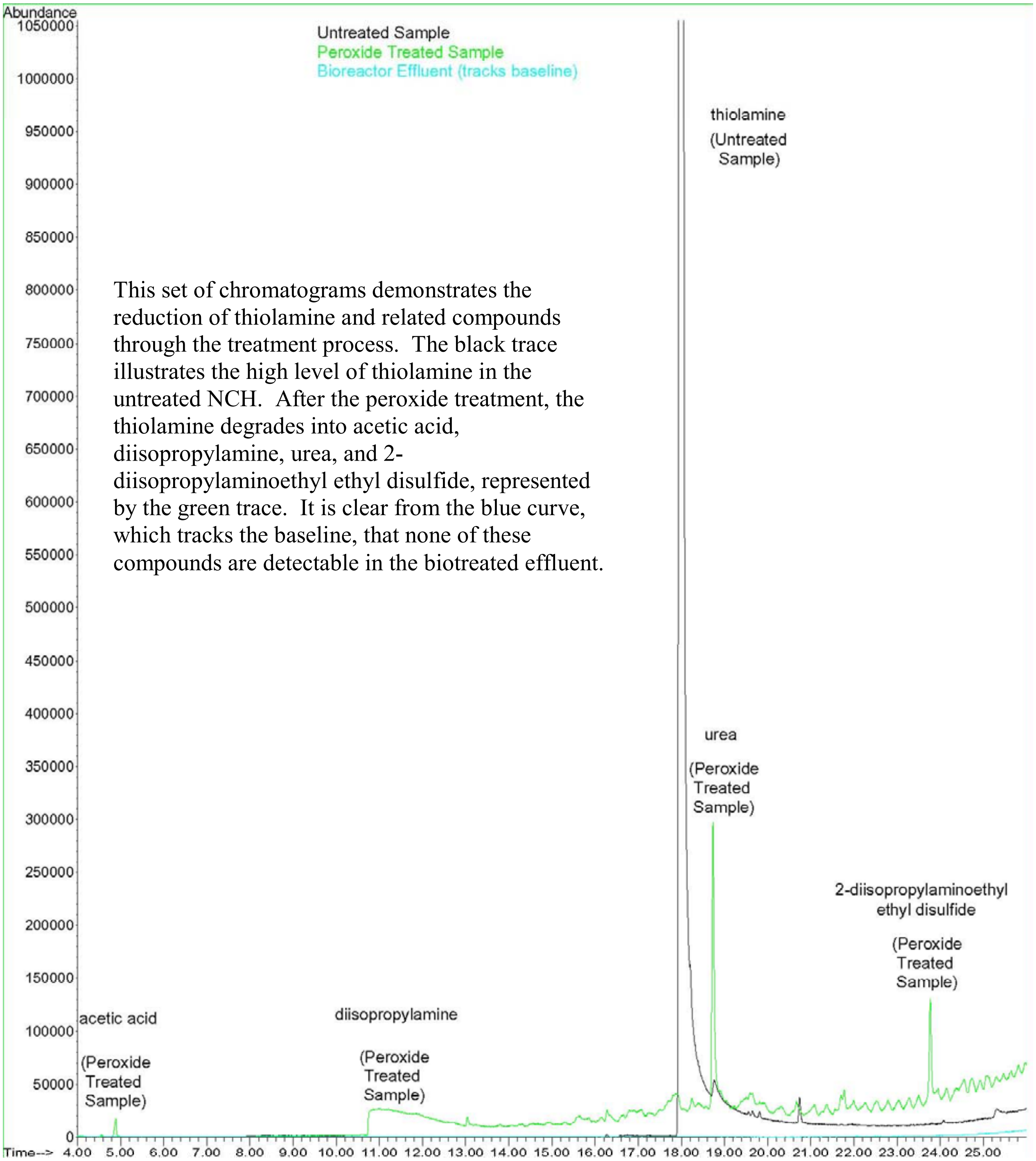
PEROXIDE TREATED SAMPLE

The peroxide treated sample was analyzed neat.

INSTRUMENT PARAMETERS

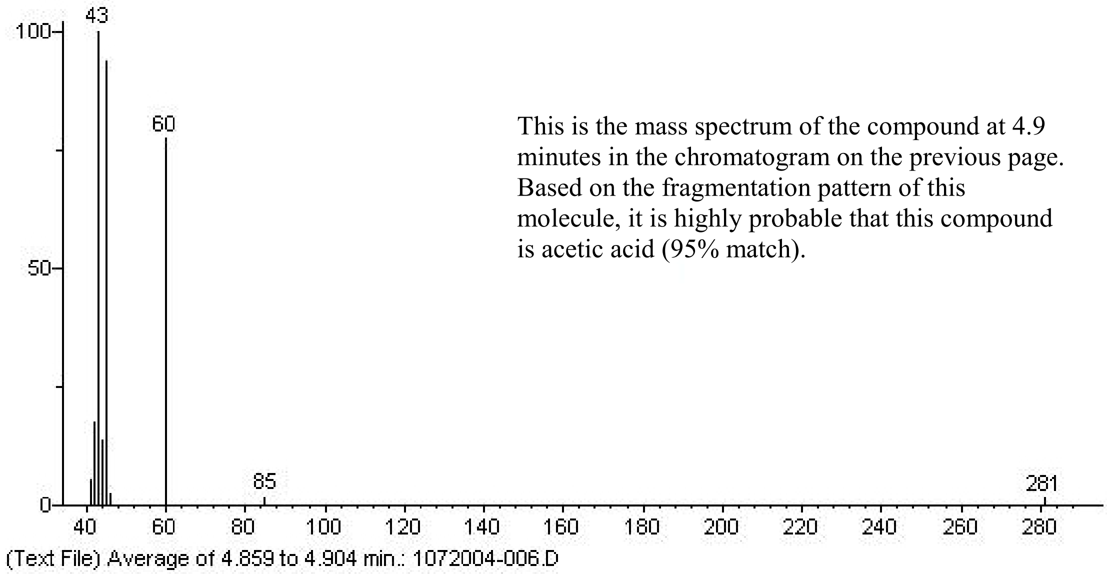
The samples are quantified using a GC-MS instrument with the following operating conditions:

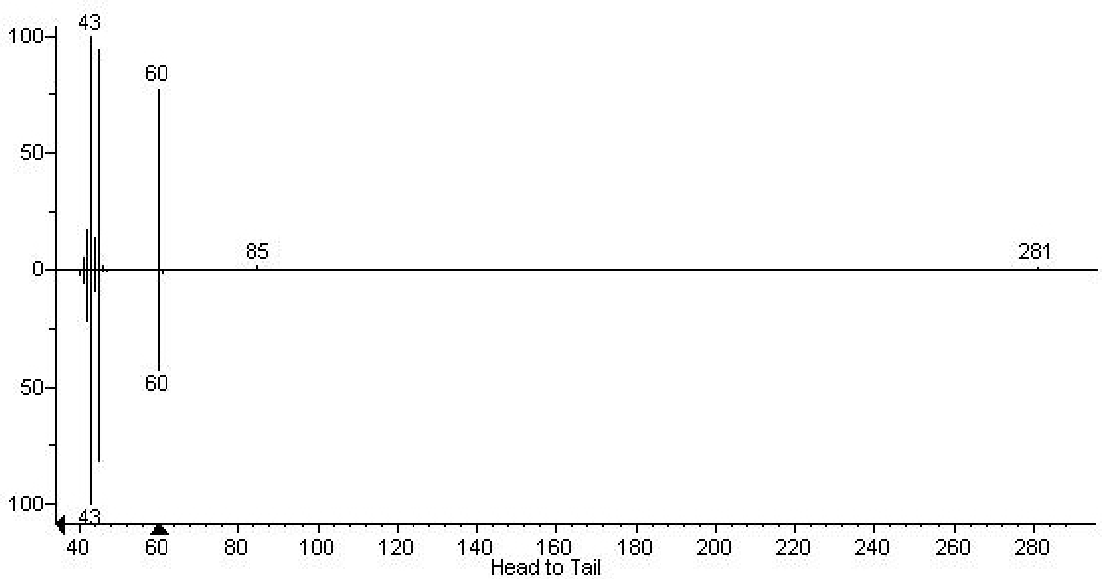
Detector	Mass Spectrometer
Split Ratio	50:1
Injection Temperature	Cool on column
MSD Transfer Line Heater	280°C
Initial Column Temperature	40°C
Pre-Program Hold	5 min
Temperature Rise	10°C/min to 300°C
Post-Program Hold	0 min
Working Column	30.0 m x 0.25 mm I.D. fused silica coated with 1.00 µm film thickness, 100% dimethyl polysiloxane bonded stationary phase
Scan Parameters	Low Mass: 35.0 High Mass: 550.0 Threshold: 150

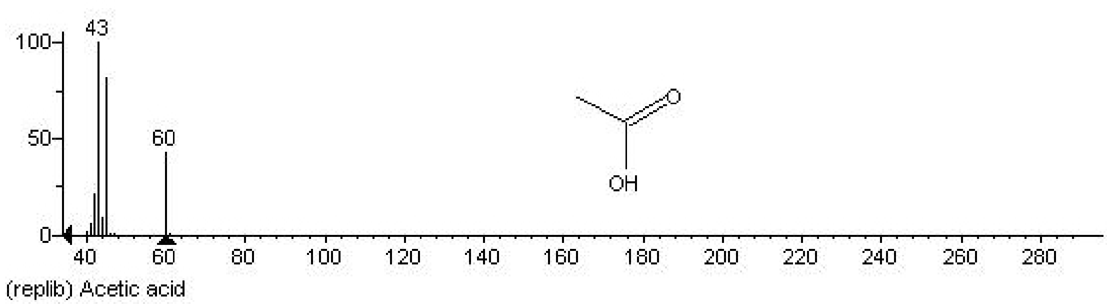

Abundance
Untreated Sample
Peroxide Treated Sample
Bioreactor Effluent (tracks baseline)
This set of chromatograms demonstrates the reduction of thiolamine and related compounds through the treatment process. The black trace illustrates the high level of thiolamine in the untreated NCH. After the peroxide treatment, the thiolamine degrades into acetic acid, diisopropylamine, urea, and 2-diisopropylaminoethyl ethyl disulfide, represented by the green trace. It is clear from the blue curve, which tracks the baseline, that none of these compounds are detectable in the biotreated effluent.
thiolamine (Untreated Sample)
urea (Peroxide Treated Sample)
2-diisopropylaminoethyl ethyl disulfide (Peroxide Treated Sample)
acetic acid (Peroxide Treated Sample)
diisopropylamine (Peroxide Treated Sample)
Time-->

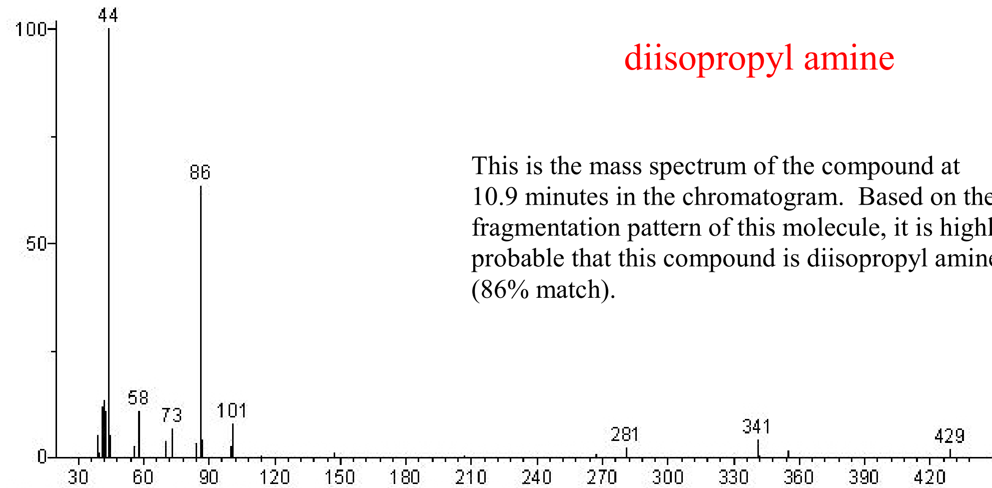
acetic acid

This is the mass spectrum of the compound at 4.9 minutes in the chromatogram on the previous page. Based on the fragmentation pattern of this molecule, it is highly probable that this compound is acetic acid (95% match).





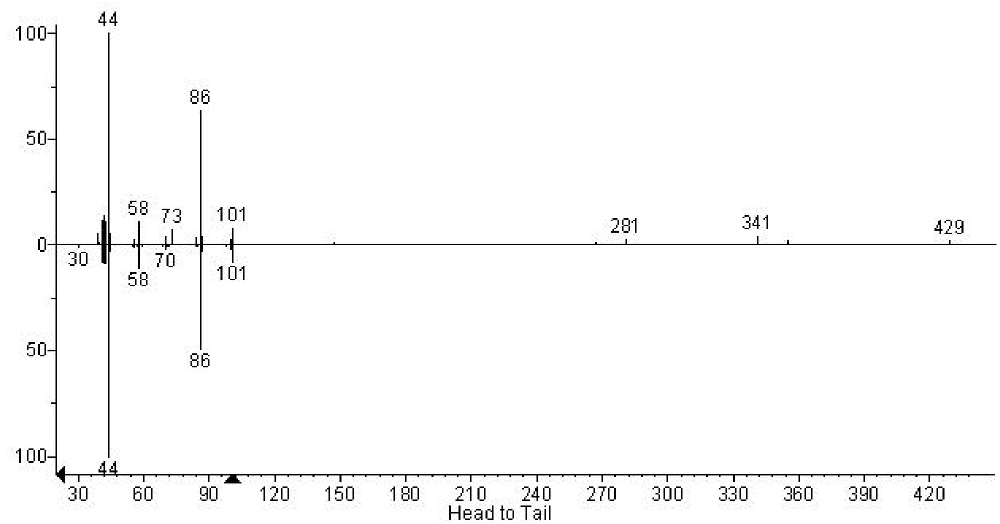


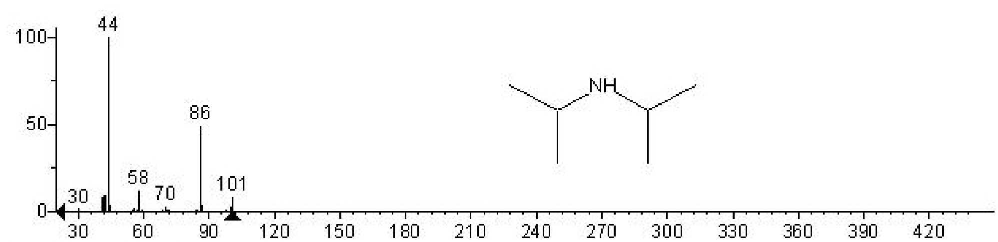


(Text File) Average of 10.761 to 11.195 min.: 1072004-006.D

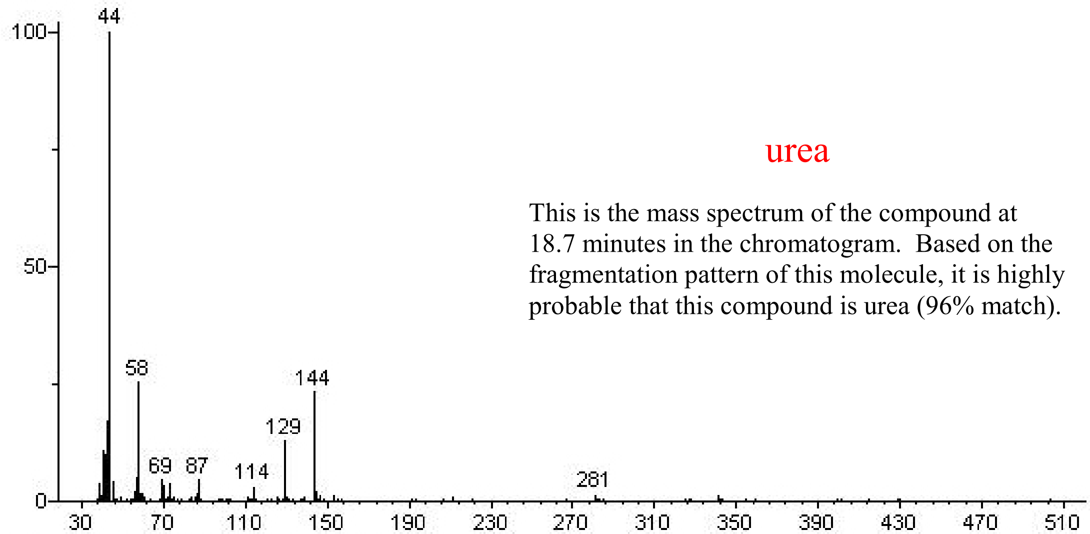
diisopropyl amine

This is the mass spectrum of the compound at 10.9 minutes in the chromatogram. Based on the fragmentation pattern of this molecule, it is highly probable that this compound is diisopropyl amine (86% match).





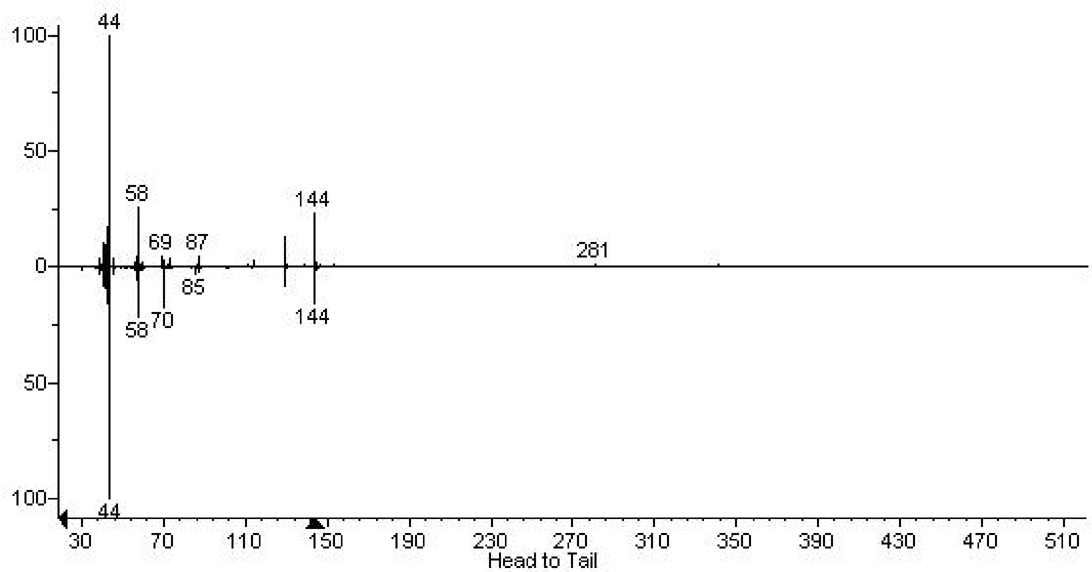
(replib) Diisopropylamine

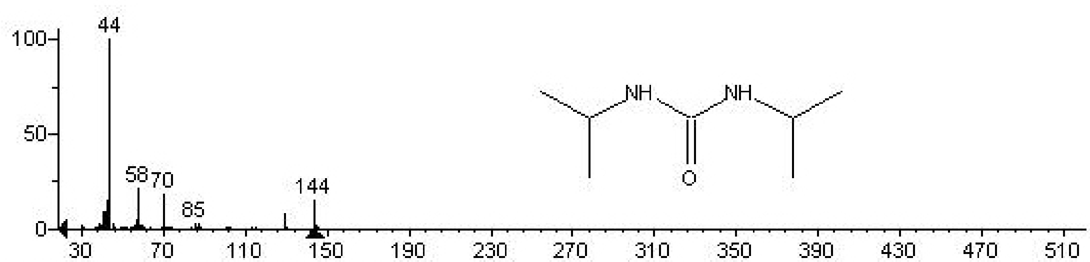


(Text File) Scan 1634 (18.730 min): 1072004-006.D

urea

This is the mass spectrum of the compound at 18.7 minutes in the chromatogram. Based on the fragmentation pattern of this molecule, it is highly probable that this compound is urea (96% match).

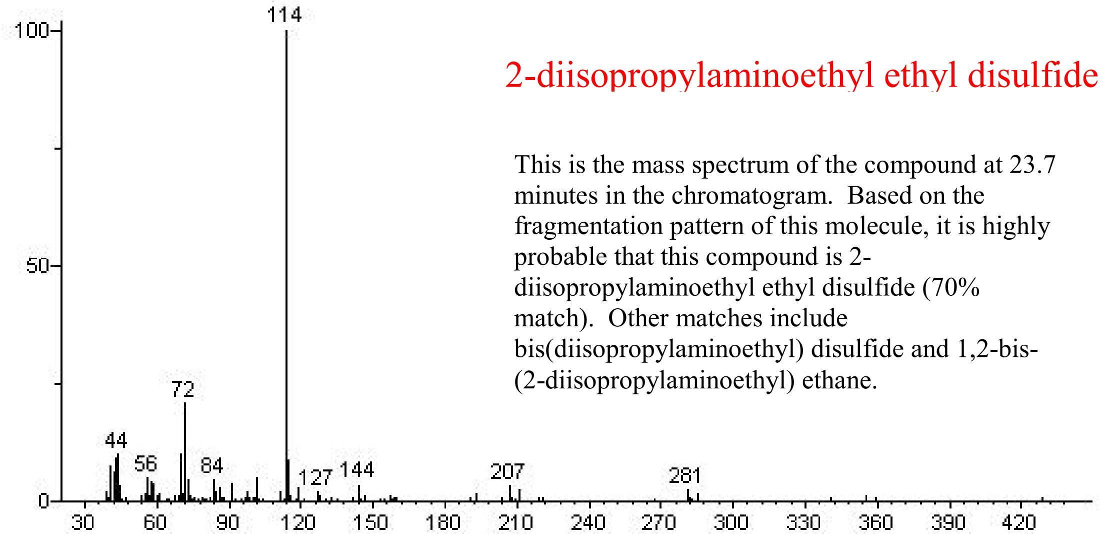




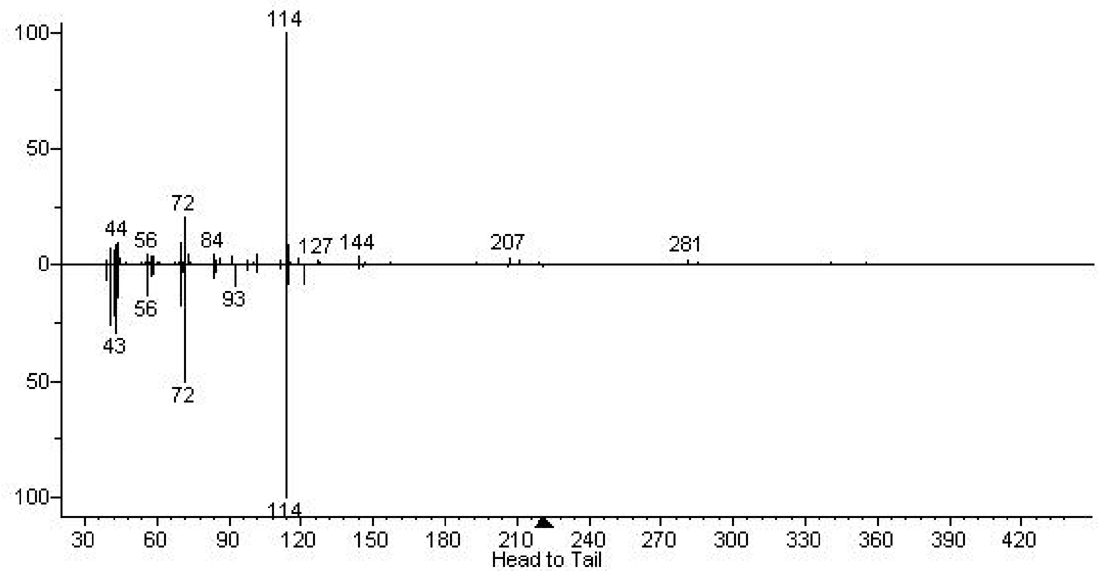
(mainlib) Urea, N,N'-bis(1-methylethyl)-

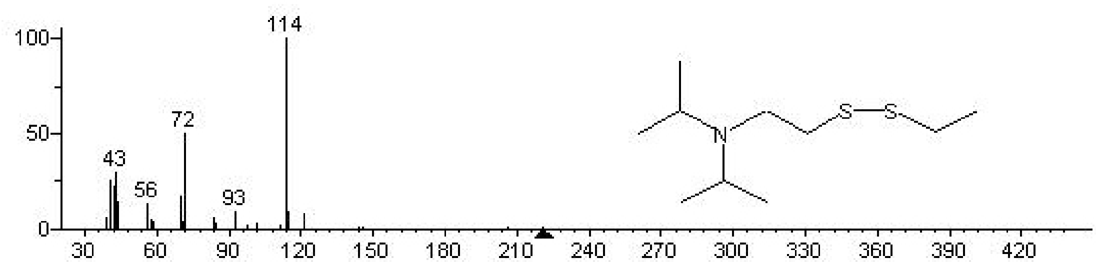
2-diisopropylaminoethyl ethyl disulfide

This is the mass spectrum of the compound at 23.7 minutes in the chromatogram. Based on the fragmentation pattern of this molecule, it is highly probable that this compound is 2-diisopropylaminoethyl ethyl disulfide (70% match). Other matches include bis(diisopropylaminoethyl) disulfide and 1,2-bis-(2-diisopropylaminoethyl) ethane.



(Text File) Average of 23.742 to 23.799 min.: 1072004-006.D





(mainlib) 2-Diisopropylaminoethyl ethyl disulfide

Appendix F:
Analytical Method for Phosphonate

GE Betz ✓Analytical Procedure

Phosphonate Test 'N Tube (T'NT)

DR 2010

Persulfate/Block Digestion Method
(0.10 to 3.50 mg/L)

SUMMARY OF METHOD

This method is based upon a heat catalyzed oxidation of phosphonates (organophosphorous compounds) to orthophosphate in the presence of persulfate. The orthophosphate reacts with the molybdate and ascorbic acid in the PhosVer 3 pillow to produce the molybdenum blue color. The phosphonate concentration is determined by subtracting the orthophosphate result obtained on an undigested sample from the digested sample result. This procedure is an excellent method for analyzing numerous phosphonate samples in a short period of time.

CHEMICALS REQUIRED	**Code**
Decompo Reagent (a)	L363.0010
Deionized Water	L243.4000
PhosVer 3 Phosphate Reagent, 10 mL	L2325

APPARATUS REQUIRED*	**Code**
COD Reactor	Hach 45600-00**
COD Vial Adapter, DR 2010	L2780
Filter Membrane, 0.22 micron	L546
Funnel, Micro	L1816
Membrane Filter Holder	L571
Photometer, DR 2010	L2800
Pipet, 5 mL Plastic Graduated 1/10 (two required)	L380
Safety Bulb, Rubber	L1575
Safety Shield, Laboratory Bench	Hach 50030-00**
Syringe, Plastic 50 mL	L775
Test 'N Tube Vials, 16 mm	Hach 22758-06**
Test 'N Tube Vial Caps	Hach 22411-06**
Test Tube Rack	L161

*** The use of safety glasses is recommended**
**** These accessories can be purchased from Hach Company, P.O. Box 608, Loveland, CO. 80539; 1-800-227-4224**

(a) Decompo reagent is Potassium Persulfate

www.gebetz.com

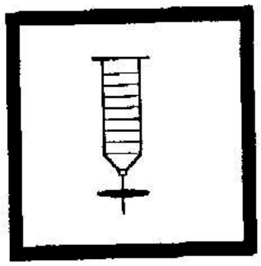
AP661 0206

Phosphonate Test 'N Tube, Persulfate/Block Digestion Method

PROCEDURE

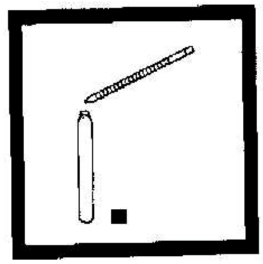
1. Turn on the COD Reactor and heat to 115-120°C. Place the safety shield in front of the reactor.

Note: *See COD Reactor manual for temperature adjustment instructions.*



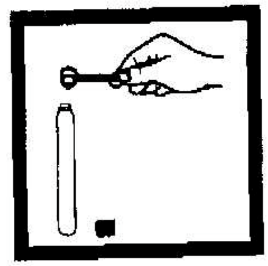
2. Filter 25 mL of sample through a 0.22-micron filter membrane apparatus.

Note: *Clean glassware with hydrochloric acid, 50% solution. Rinse three times with deionized water. Do not use detergents containing phosphates to clean glassware.*



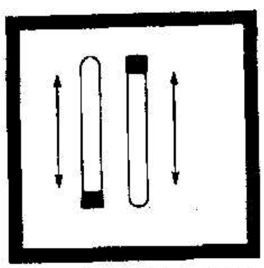
3. Using a 5-mL graduated plastic pipet, add 5 mL of filtered sample to a T'NT vial.

Note: *A safety bulb must be used when pipetting.*

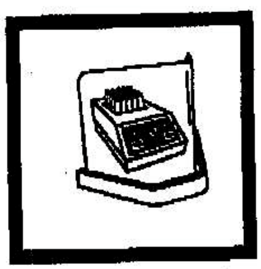


4. Add 1 level dipper of Decompo Reagent to the T'NT vial. (0.19)

Note: *Use the dipper in the cap of the Decompo Reagent Container.*

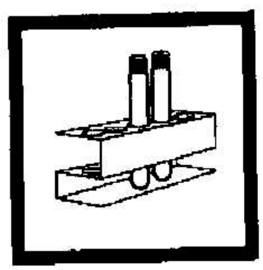


5. Cap the T'NT vial tightly and invert to mix.

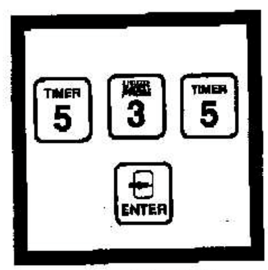


6. Heat the vial for 5 minutes in the COD Reactor.

Note: *The conversion step to phosphate normally should be completed in 5 minutes. However, some sample matrices could require longer conversion times. Check efficiency by running a longer digestion time (e.g. 10 minutes) to determine if sample concentration increases.*



7. Carefully remove the **hot** vial from the COD Reactor. Place in a test tube rack and allow to cool to room temperature.



8. Enter the DR 2010 stored program number for T'NT phosphate.
Press: ~~**595 Enter.**~~ 3036

The display will show:

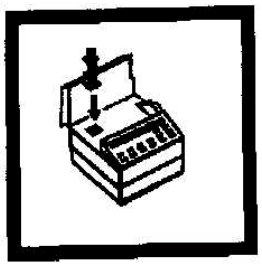
Dial nm to 890.

Rotate the wavelength dial until the display shows: **890 nm.** The display will quickly show:

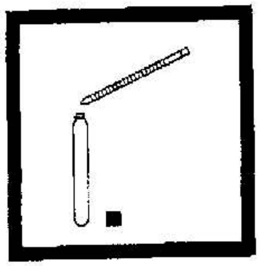
Zero Sample.

Then: **mg/L PO_4^{3-} Vial.**

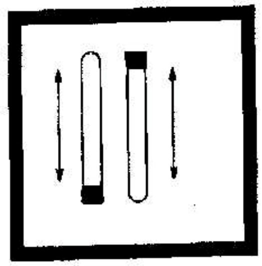
Phosphonate Test 'N Tube, Persulfate/Block Digestion Method



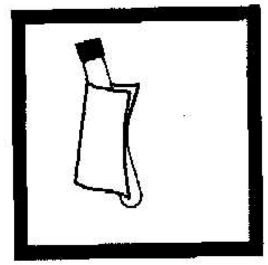
9. Place the COD Vial Adapter into the DR 2010 cell holder with the marker to the right.



10. Using a 5 mL graduated plastic pipet, add 4 mL of deionized water to the digested sample T'NT vial.

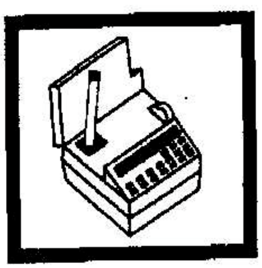


11. Cap the vial tightly and invert to mix.

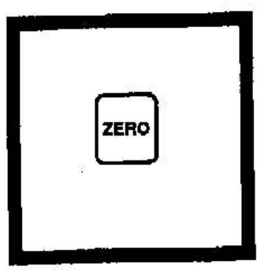


12. Clean the outside of the vial with a towel.

***Note:** Wiping with a damp towel, followed by a dry one, will remove fingerprints or other marks.*



13. Place the sample vial in the COD Vial adapter with the logo facing the front of the instrument. Place the cover on the adapter.



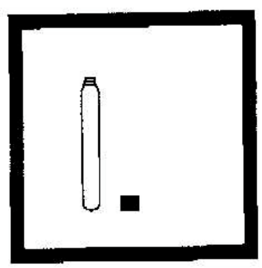
14. Press: **Zero**

the display will show:

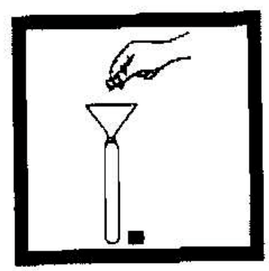
Wait

then

0.00 mg/L PO_4^{3-} - Vial.

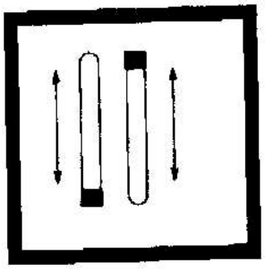


15. Remove the cap from the vial.

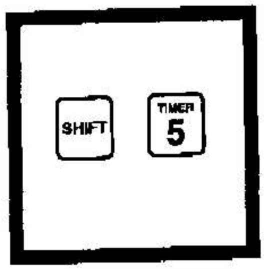


16. Using a micro funnel, add the contents of one PhosVer 3 powder pillow for 10-mL samples to the vial.

Phosphonate Test 'N Tube, Persulfate/Block Digestion Method



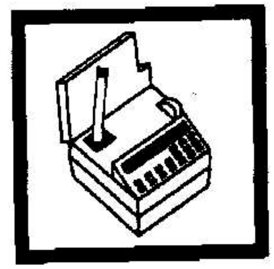
17. Cap the vial tightly and shake to mix.



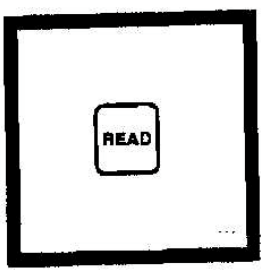
18. Press: **Shift Timer**

A two-minute reaction period will begin.

19. After the timer beeps, clean the outside of the sample vial with a towel.



20. Place the prepared sample vial into the adapter with the logo facing the front of the instrument. Place the cover on the adapter.



21. Press: **Read**

The display will show:

Reading

Then the display will show the results in mg/L PO_4^{3-}. (b)

***Note:** If the sample concentration is above 3.50 mg/L PO_4^{3-}, the sample must be diluted and rerun.* (c)

***Note:** To obtain the phosphonate concentration in the presence of orthophosphate, prepare a second sample vial of 5 mL of filtered sample and 4 mL of deionized water and follow the procedure beginning with Step 11.*

***Note:** The sample's active phosphonate concentration is determined by subtracting the undigested sample result from the digested sample result and multiplying by the appropriate conversion factor in Table 1 (see Table 2).*

Table 1. Phosphonate Conversion Factors

Phosphonate	Conversion Factor
AMP	1
HEDP	1
HPAA	1.49
PAMP	1.21
Tetraphosphonate	1.29
USP(PBSAM)	2.84

Table 2. Calculation Example

Digested Sample Result	2.44 mg/L PO_4^{3-}
Undigested Sample Result	0.03 mg/L PO_4^{3-}
Phosphonate	HPAA

HPAA concentration (mg/L) =
(2.44 - 0.03) x 1.49 = 3.59

(b) will HACH displays as PO_4^{-3} - P, also.

(c) NCH samples (fdc eff) were dilute 1/25 to eliminate color interference. MDL = 0.3 mg/L P for these samples

Appendix G

Respirometry Results on Newport (Indiana) Caustic Hydrolysate

added to Wastewater from the SET WWTP
Summary Report of Results

Background and Methods

Respirometry was used to assess the relative treatability of a sample of Newport (Indiana) caustic hydrolysate (NCH) in order to provide a preliminary screen of the ability of the DuPont Secure Environment Treatment (SET) facility to treat this stream. Respirometric methods measure the oxygen consumed (and carbon dioxide generated) by microorganisms in a closed vessel under conditions of constant temperature and agitation and are used for assessing the biodegradation of specific chemicals; treatability of organic industrial wastes and evaluating the potential toxic effects of compounds on wastewater microorganism. The study was performed in three separate DuPont locations using two different types of respirometers. The BI-1000 from Bioscience, Inc., used at Chambers Works Waste Acceptance (WA) and Experimental Station Wastewater (WWL) Laboratories is an electrolytic respirometer which monitors the amount oxygen required to maintain constant oxygen pressure within the reaction vessel. The Columbus Instrument Micro Oxymax, used at Corporate Center for Engineering Research (CCER) Glasgow Facility, measures the rate of oxygen and carbon consumption and generation directly in the sample vessel headspace.

Industrial wastewater from the SET facility from Spots 803 (for WWL studies)[18] and 529[19] (WA and CCER) was utilized as the test matrix for the studies. Mixed liquor suspended solids (MLSS), sampled from the first stage of the PACT® facilities at the WWTP, were the microbial inoculum for the study. The test units were seeded with 200 mL of MLSS (100ml for the WWL studies) that was centrifuged, decanted and washed twice with deionized water before use. Reformulated 16% NCH was tested. Both the DCC and the DIC stabilized materials were used in separate tests. The pH of the NCH was adjusted to approximately 6.0 by the addition of 20% sulfuric acid

[18] Spot 803 is the feed sampling spot at the WWTP that excludes off-site wastewaters.
[19] Spot 529 is the feed sampling spot at the WWTP that includes both on-site and off-site wastewaters.

(NCH/pH) and pretreated by the addition of 10% hydrogen peroxide (NCH/pH/H2O2). The oxygen consumptions in the NCH/pH and NCH/pH/H2O2 vessels at loadings of 0.05, 0.1, and 0.2% (that is, 1:2000, 1:1000 and 1:500 NCH:WWTP feed volume ratios, respectively) were monitored for a minimum of 5 days and compared to the control vessels that contained only the neutralized SET wastewater. In addition, DCC stabilized NCH at a 0.4% (1:250) loading and the caustic hydrolysate containing the DIC stabilizer at 0.05 and 0.1% (1:2000 and 1:1000, respectively) loadings were evaluated at the CCER laboratory.

The initial respirometry results from all laboratories indicated the addition of NCH/pH at loading of 0.05, 0.1 and 0.2% did not have any negative effect on the respiration rate (Figures 1-3) and results at the highest test concentration (0.2%) demonstrated an enhancement in the respiration rate. The hydrogen peroxide pretreatment at 1:1 ratio (that is, approximately 10% peroxide added to 16% NCH) appeared to slightly suppress the cumulative oxygen consumption in the WWL and WA laboratory studies at 0.05, 0.1 and 0.2% loading (Figures 1 and 2) but not CCER reactors at the highest loading level of 0.4% (Figure 4). Subsequent studies indicated that the 1:1 hydrogen peroxide:NCH ratio (*i.e.*, 10% peroxide dose) resulted in excessive residual hydrogen peroxide that was not removed prior to respirometry testing. This excess hydrogen peroxide resulted in residual oxygen so the electrolytic respirometers at the WA and WWL laboratories did not have to generate additional oxygen to maintain a constant oxygen pressure in the system (the basis for assessing oxygen uptake in these systems). The Micro Oxymax measures the rate of oxygen consumption directly in the headspace of the reactors and was not affected by the excess peroxide in the system. There was no difference in the treatability of caustic hydrolysate derived from either DIC or DCC stabilized materials. In studies performed at Glasgow CCER, the DIC stabilized NCH/pH and NCH/pH/H2O2 at 0.05 and 0.1% loadings did not inhibit the respiration rate of the cultures (Figures 5 and 6) and an enhancement of respiration was observed in the NCH/pH sample at 0.1% loading.

The respirometry studies at Waste Acceptance, Experimental Station Wastewater and Glasgow CCER laboratories demonstrated the addition of pH adjusted or hydrogen peroxide treated NCH derived from either DCC or DIC stabilized materials does not adversely affect the respiration rate of the wastewater microorganisms. The 0.05, 0.1, 0.2 and 0.4% (CCER only) loadings in the studies indicate the SET facility may have the ability to accept in excess of 4 trucks/day of 16% NCH without adversely affecting the operation of the plant.

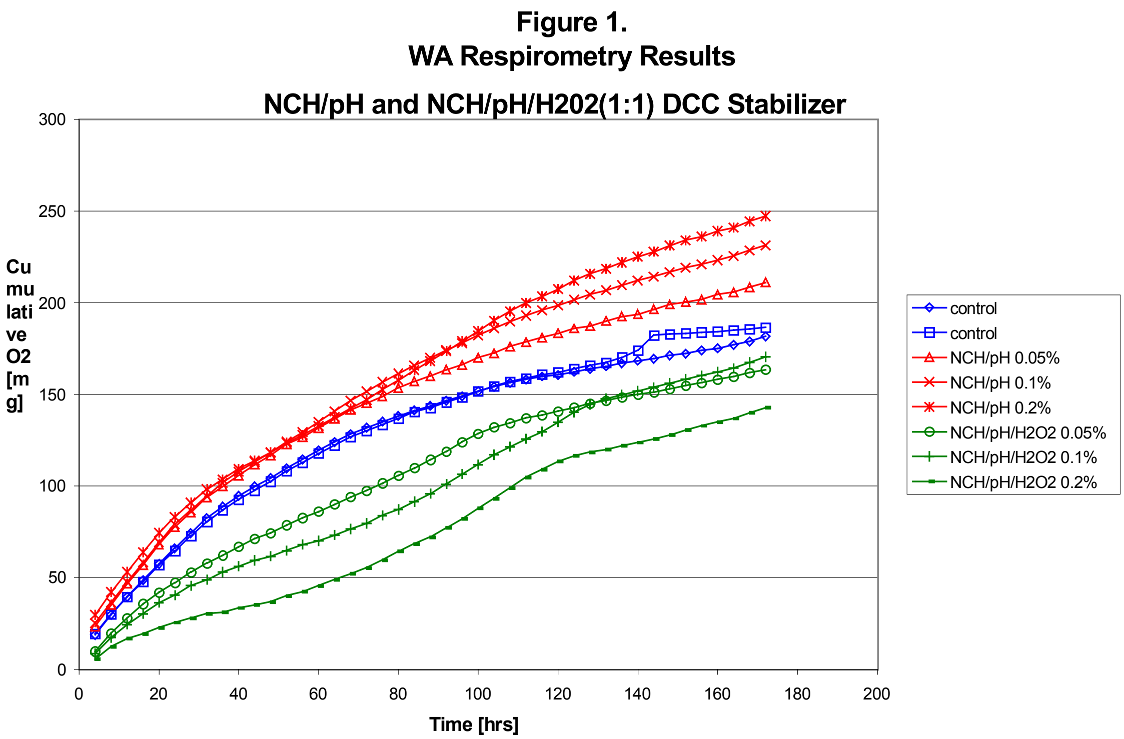


Figure 1.
WA Respirometry Results
NCH/pH and NCH/pH/H202(1:1) DCC Stabilizer
Cumulative O2 [mg]
Time [hrs]
0
50
100
150
200
250
300
0
20
40
60
80
100
120
140
160
180
200
control
control
NCH/pH 0.05%
NCH/pH 0.1%
NCH/pH 0.2%
NCH/pH/H2O2 0.05%
NCH/pH/H2O2 0.1%
NCH/pH/H2O2 0.2%

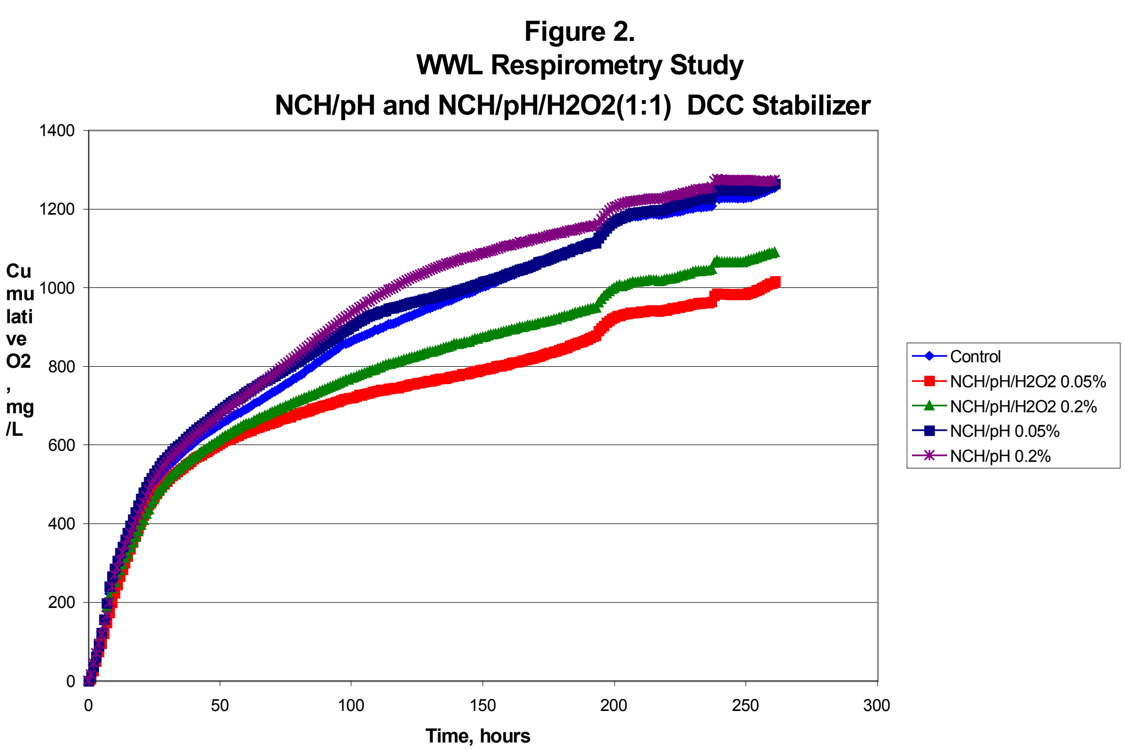


Figure 2.
WWL Respirometry Study
NCH/pH and NCH/pH/H2O2(1:1) DCC Stabilizer
Cumulative O2, mg/L
Time, hours
0
200
400
600
800
1000
1200
1400
0
50
100
150
200
250
300
Control
NCH/pH/H2O2 0.05%
NCH/pH/H2O2 0.2%
NCH/pH 0.05%
NCH/pH 0.2%

Figure 3.
CCER Respirometry Results

NCH/pH DCC Stabilized

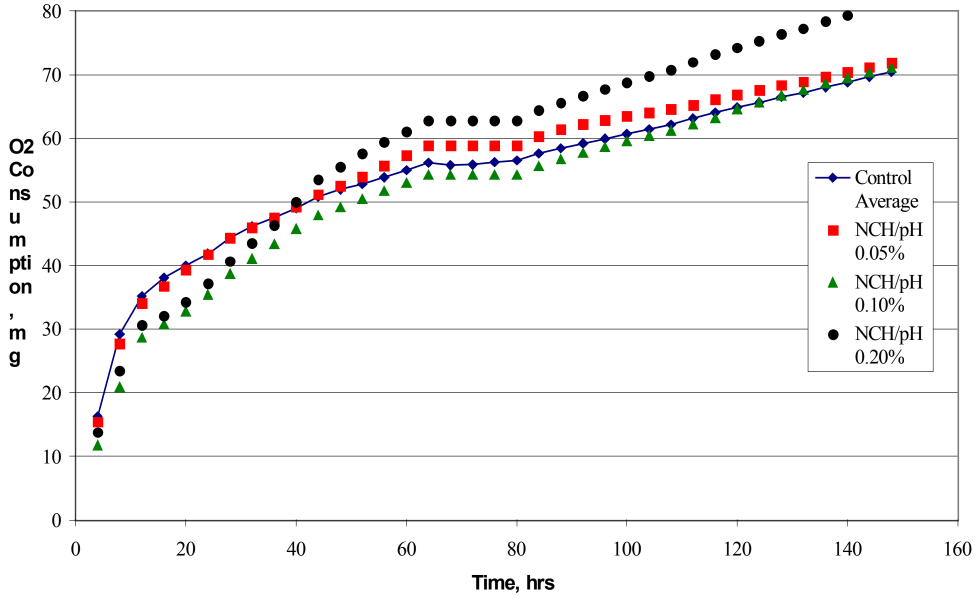
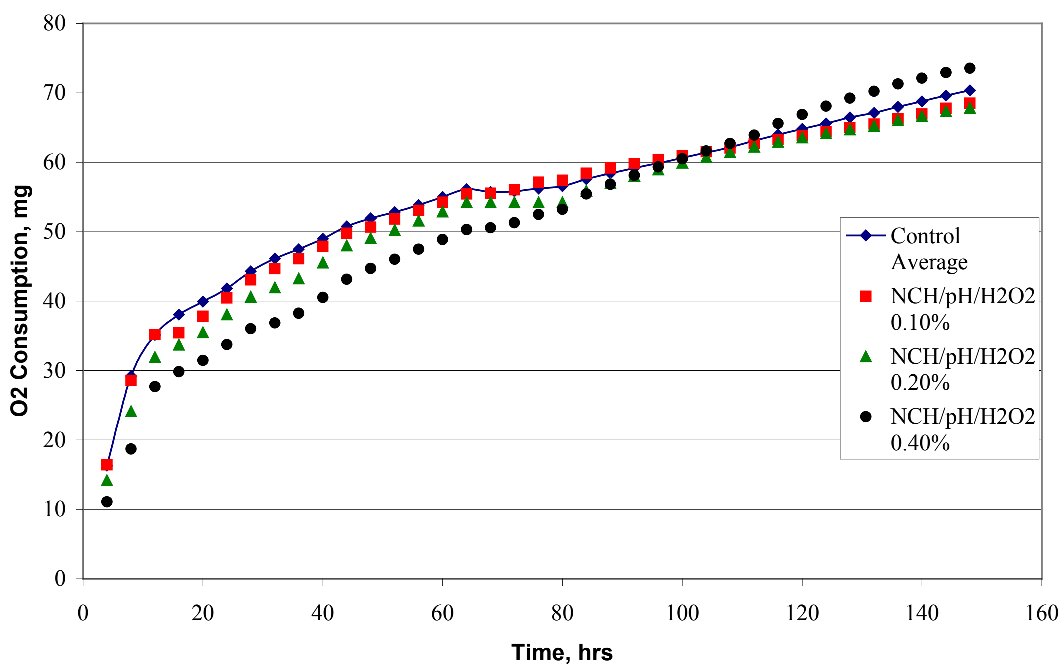


Figure 4: CCER Respirometry Results
NCH/pH/H2O2 (1:1)
DCC Stabilized



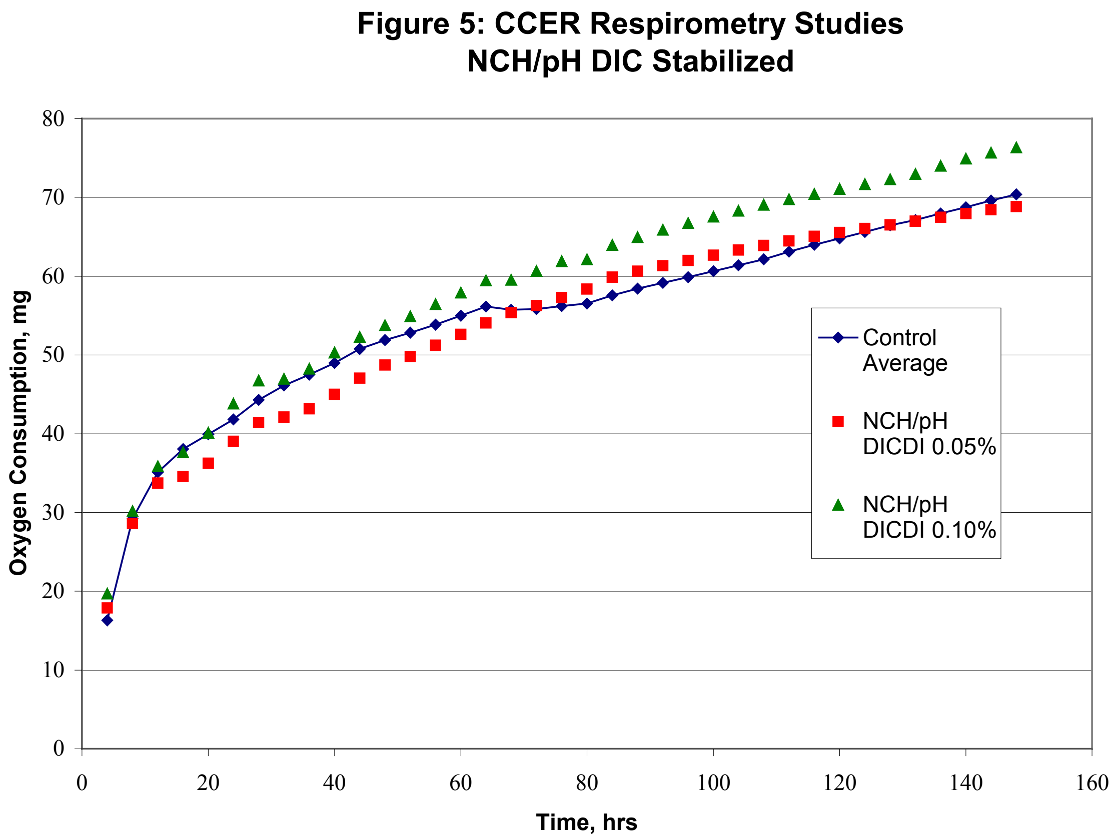
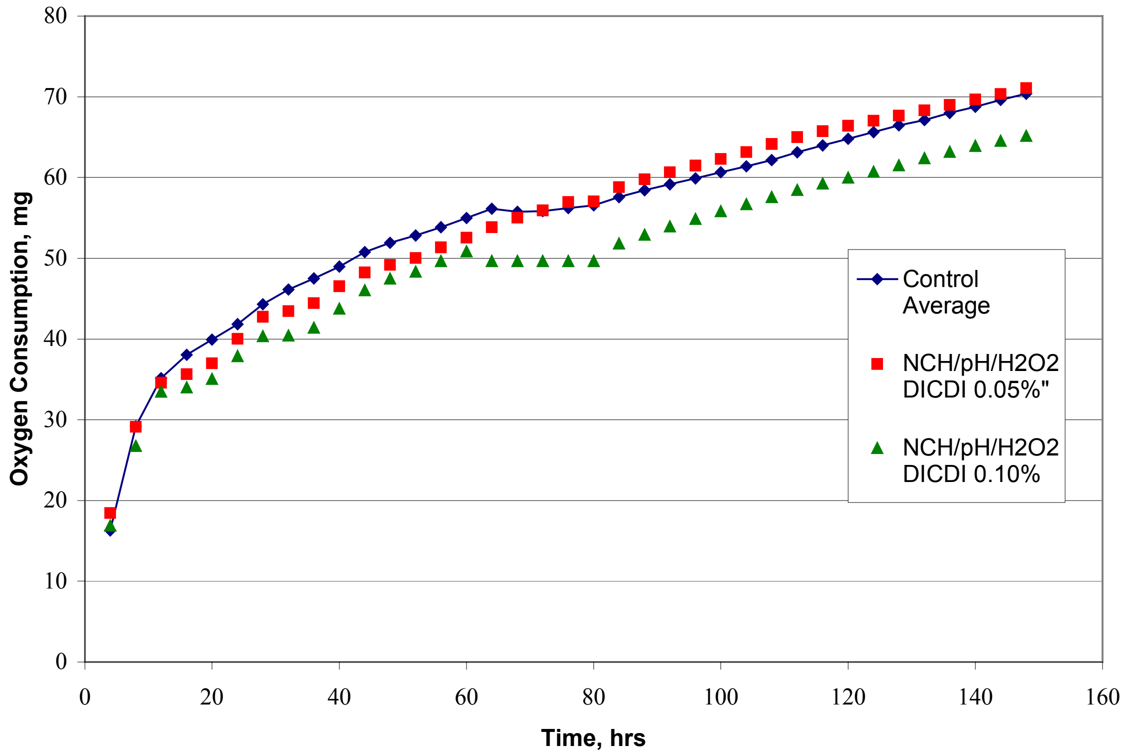


Figure 5: CCER Respirometry Studies
NCH/pH DIC Stabilized
Oxygen Consumption, mg
Time, hrs
0
10
20
30
40
50
60
70
80
0
20
40
60
80
100
120
140
160
Control Average
NCH/pH DICDI 0.05%
NCH/pH DICDI 0.10%

**Figure 6: CCER Respirometry Studies
NCH/pH/H2O2 (1:1) DIC Stabilized**



Appendix H.
Whole Effluent Toxicity Screening Test Results

Bioreactor Effluent Testing January 2004

Fathead Minnow Daily Renewals

Reactor Effluent Number	Sample Date	LC50 (percent sample)	Percent Survival Control	3.1	6.25	12.5	25	50
1 - Control	1/2/2004	>50	100	100	90	100	100	60
2 - NPBC-r	1/2/2004	46.6 (37.6 - 57.8)	100	100	100	100	100	40
3 - NPBC-a	1/2/2004	20.3 (17.0 - 24.2)	100	100	100	100	20	0
4 - NP2xC-r	1/2/2004	>50	100	100	100	100	100	80
5 - NABC-r	1/2/2004	>50	100	100	100	100	100	80
6 - FBC-r	1/2/2004	>50	100	100	100	100	100	80
7 - FBC-a	1/2/2004	>50	100	100	100	100	90	80
8 - NPBI-a	1/2/2004	>50	100	100	100	100	100	100
9 - NP4xC-r	1/2/2004	36.7 (33.9 - 39.9)	100	100	100	N/A	100	10
10 - NPBI-r	1/2/2004	>50	100	100	100	100	80	70
1 - Control	1/8/2004	>50	100	100	100	100	100	90
2 - NPBC-r	1/8/2004	>50	100					90
3 - NPBC-a	1/8/2004	>50	100	100	100	100	100	100
4 - NP2xC-r	1/8/2004	>50	100					100
5 - NABC-r	1/8/2004	>50	100					80
6 - FBC-r	1/8/2004	>50	100					90
7 - FBC-a	1/8/2004	>50	100					90
8 - NPBI-a	1/8/2004	>50	100					100
9 - NP4xC-r	1/8/2004	>50	100				100	100
10 - NPBI-r	1/8/2004	>50	100					80
11 - Control	1/16/2004*	>50	100	100	100	100	100	70
12 - NPBC-a	1/16/2004*	>50	100	100	100	90	100	100

* Reactors were rearranged after 1/9/2004. However, these two reactors represent feeds and reactor conditions that were identical to those of Reactors #1 and 3, respectively, prior to 1/9/2004.

Values in blue not obtained with CO_2 headspace.
Values in black obtained with CO_2 headspace

EA Engineering Science and Technology
15 Loveton Circle
Sparks, MD 21152

Appendix I:
Biotreatability Test Operating Data

		Chambers Works #1Control																
		FEED																
DAY	DATE	Feed DOC sol	COD tot	COD, sol	BOD, sol	NO2-N	NO3-N	NH3-N	TN, inst	TDS	SO4	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/L	mg/L	Calc		mg/L	mg/L	mg/L
1	10/15/2003																	
2	10/16/2003	372							97									
3	10/17/2003	358		932	589	<1	<.5		81		1502	8.1				<2.5		
4	10/18/2003																	
5	10/19/2003																	
6	10/20/2003	348	1313	1030		<1	<.5		76		1483	7.9				<2.5	0	
7	10/21/2003	331							111	2973							0	
8	10/22/2003	333		1156	547	<1	<.5		109		1514	6.2	7.3	1.1	4.4	<2.5	0	
9	10/23/2003	258							67									
10	10/24/2003	258		1124		<1	0.26	24	59		1549	7.3	6.1	-1.2	-4.8	<2.5	0	
11	10/25/2003																	
12	10/26/2003																	
13	10/27/2003	292	1434	1247		<1	<.5		84		1506	5.5	7.1	1.6	6.5	<2.5	0.00	9.9
14	10/28/2003	238							70	2800								
15	10/29/2003	239		1220	521	<1	<.5				1526	7.0	8.2	1.2	4.6	<2.5	0.00	
16	10/30/2003	253							42									
17	10/31/2003	253				18.75	<.5		38		578	4.8	6.7	1.9	7.6	<2.5	0.00	
18	11/01/2003																	
19	11/02/2003																	
20	11/03/2003	208	688	707		19.4	<.5		48		524	3.8	5.5	1.7	7.0	<2.5	0.00	
21	11/04/2003	194							44	3860								
22	11/05/2003	201		674	280				44				5.7					
23	11/06/2003	201				11.99	<.5	12.89	40		537					<2.5	0.00	
24	11/07/2003	183							36			3.2	6.4	3.3	13.0			
25	11/08/2003																	
26	11/09/2003																	
27	11/10/2003	158	716	482		<1	<.5		31		609	3.0	5.9	3.0	11.8	<2.5	0.00	
28	11/11/2003	182							23	3553								
29	11/12/2003	192		544	446				23			4.5	5.9	1.4	5.8		0.00	
30	11/13/2003	148		534		<1	1	10	22		655					<2.5		
31	11/14/2003	151							21			5.0	6.7	1.7	6.6		0.00	

		Chambers Works #1 Control																			
		EFFLUENT																			
DAY	DATE	Eff 1 DOC	COD tot	Eff 1 COD, sol	Eff 1 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phosphonate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
1	10/15/2003																				
2	10/16/2003	35					67														
3	10/17/2003	39		160	2		67	28	20		<1	10.56	1983	5.55	6.33				<2.5		
4	10/18/2003																				
5	10/19/2003																				
6	10/20/2003	46	127	89			51	22	10		<1	<.5	1716	2.19	3.3				<2.5	0	
7	10/21/2003	38					60			3267										0	
8	10/22/2003	89		116			105	25	15		1.66	2.53	1671	3.13	3.3	4	0.7	2.8	<2.5	0	
9	10/23/2003	89					108														
10	10/24/2003	81		156		41.2	127	40	17		<1	3.18	1721	2.89					<2.5	0	
11	10/25/2003																				
12	10/26/2003																				
13	10/27/2003	21	167	129				21	19		1.24	12.13	1601	2.53		3.8	1.27	5.1	<2.5	0	9.7
14	10/28/2003	32					52			2893											
15	10/29/2003	29		96	2		49	57	39		<1	9.51	1598	2.68	2.64	3.6	0.92	3.7	<2.5	0	
16	10/30/2003	45					46														
17	10/31/2003	57					50	46	34		1.19	24.97	1740	5		6	1	4.0	<2.5	0	
18	11/01/2003																				
19	11/02/2003																				
20	11/03/2003	34	76	101			38	42	32		<1	33.86	774	2.95		4.2	1.25	5.0	<2.5	0	
21	11/04/2003	35					38			3280											
22	11/05/2003	34		107	4		32	32	22					2.46		3.5	1.04	4.2			
23	11/06/2003	34				1.3	30				<1	24.05	571	2.46					<2.5	0	
24	11/07/2003	34					33	43	28					2.46		4	1.54	6.2			
25	11/08/2003																				
26	11/09/2003																				
27	11/10/2003	38	201	197			31	51	19		<1	23.99	622	2.02		3.8	1.78	7.1	<2.5	0	
28	11/11/2003	43					18			3567											
29	11/12/2003	48		144	17		13	31	16					1.9		4	2.1	8.4		0	
30	11/13/2003	45		113		5.12	9				<1	6.09	641	1.94					<2.5		
31	11/14/2003	30					5	27	11							3.5	3.5	14.0		0	

		Chambers Works #1 Control														
		UNIT PERFORMANCE														
					FEED VOL											
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR
		mg/L	mg/L	L	L	L	L					mg/L		mL/L	mL/g	mg/L/hr
1	10/15/2003								7.56			5.3	22.6			
2	10/16/2003			4.1	4.6	0	4.6	2941	6.36	7.47	5.46	1.9	21.9			
3	10/17/2003	14310	9080	3.6	4.6	1	3.6	2941	6.16	7.15	5.58	4.2	22.2			34.2
4	10/18/2003			6.1	14.6	8.2	6.4	2941	6.49	7.33	5.90	1.3	23.3			
5	10/19/2003			6.1	8.2	2	6.2	2941	6.55	7.23	6.31	3.9	19.8			
6	10/20/2003	14215	9063	2.0	2	0	2	2941	6.45	7.27	6.02	4.2	19.9			26.8
7	10/21/2003			4.5	4.6	0	4.6	2941	6.60	7.27	5.98	2.3	20.1			
8	10/22/2003	13937	9163	4.4	4.6	0	4.6	2941	6.06	7.39	6.10	3.9	19.7			22.2
9	10/23/2003			4.4	4.6	0	4.6	2941	6.62	7.23	6.29	1.1	21.3			
10	10/24/2003	14354	9408	4.4	4.6	0	4.6	2941	6.50	7.34	5.48	3.1	22.7			43.9
11	10/25/2003			5.1	14	8.9	5.1	2941	6.66	--	--	1.9	22.8			
12	10/26/2003			4.1	8.9	4.9	4	2941	6.53	7.50	5.91	3.0	20.8			
13	10/27/2003	14815	9970	3.7	4.9	0.5	4.4	2941	6.49	7.42	5.92	2.9	19.8			52.2
14	10/28/2003			4.2	4.6	0.5	4.1	2941	6.54	7.28	--	1.5	21.3			
15	10/29/2003	15425	10457	4.3	4.6	0	4.6	2941	6.48	7.40	5.27	2.3	21.0			33.3
16	10/30/2003			3.9	4.6	1	3.6	2941	6.50	7.35		1.6	21.6			
17	10/31/2003	12980	8860	4.0	4.6	0.1	4.5	**2947-1a**	6.35	7.01	5.58	3.3	21.6			
18	11/01/2003			4.6	14	8.6	5.4	2947-1a	6.41	6.74	5.58	5.4	21.1			
19	11/02/2003			4.3	8.6	4.6	4	2947-1a	6.50	6.80	5.58	5.9	20.8			
20	11/03/2003	11744	8004	3.1	4.6	0	4.6	2947-1a	6.64	6.78	5.80	6.1	20.8			24.8
21	11/04/2003			4.2	4.6	0	4.6	**2947-1b**	6.63	7.15	5.54	5.7	20.5			
22	11/05/2003	11165	7535	4.0	4.6	0	4.6	2947-1b	6.52	7.17	5.54	6.2	20.6	230	21	45.3
23	11/06/2003			4.3	4.6	0.5	4.1	2947-1b	6.74	7.05	5.55	4.7	20.8			
24	11/07/2003	12464	8401	4.2	4.6	0.5	4.1	**2947-1c (60%)**	6.73	7.00	5.61	5.7	21.4			24.9
25	11/08/2003			4.7	14	9.3	4.7	2947-1c 60%	6.64	7.12	5.94	4.6	21.6			
26	11/09/2003			4.1	9.3	5	4.3	2947-1c 60%	6.73		5.65	4.6	23.1			
27	11/10/2003	10077	6703	3.8	5	0	5	**2947-1c**	6.52	7.12	5.69	5.2	22.4			19.3
28	11/11/2003			3.9	4.6	0.5	4.1	**2947-1d 50%**	6.51	6.94	5.80	5.6	22.8			
29	11/12/2003	10647	7107	4.2	4.6	0.4	4.2	2947	6.64	7.12	6.33	2.1	20.3	220	21	26
30	11/13/2003			4.2	4.6	0	4.6	2947	6.70	7.18	5.49	5.0	19.7			
31	11/14/2003	9613		4.2	4.69	0	4.69	2947	6.42	7.13	6.74	5.0	18.9			10.8

DAY	DATE	pH controllers INITIAL 1.0N H2SO4 mL	pH controllers FINAL 1.0N H2SO4 mL	1.0N H2SO4 con-sumed mL	pH controllers INITIAL Bicarb mL	pH controllers FINAL Bicarb mL	Bicarb con-sumed mL	Waste Vol mL	Chambers Works #1 Control COMMENTS
1	10/15/2003	175	175	0	175	175	0		Started feeding CW WW spot 529, drum 2941. Bugs rec'd 10/14/03. pH adjusted to 6, 1d/L H3PO4, 4.6L/day (3.2mL/min)
2	10/16/2003	175	175	0	175	175	0		Lowered H3PO4 to 1drop/2L.
3	10/17/2003	175	170	5	175	175	0		high DO, lowered air. Beautiful, clear supernate
4	10/18/2003	170	150	20	175	175	0		increased DO to "3". Clear super, no foaming
5	10/19/2003	150	130	20	175	175	0		DO set a tad high, lowered to 3. Clear super, no foaming
6	10/20/2003	130	125	5	175	175	0		Sl turbid super, no foam. Rx looks great.
7	10/21/2003	125	125	0	175	175	0		Rx Good
8	10/22/2003	125	100	25	175	175	0		pH low, adjusted low setting. Rx looks good.
9	10/23/2003	100	75	25	175	175	0		clear brown supernate, Rx looks good.
10	10/24/2003	200	200	0	175	175	0		clarifier slightly turbid. Rx looks good. Start VCH additions to Rxs
11	10/25/2003	200	200	0	175	175	0		Lowered feed rate a little, Increased air to 35. Some "bubbles", not foam. Clear super.
12	10/26/2003	200	180	20	175	175	0		Clarifier excellent, about 1/4" light foam in aerator..
13	10/27/2003	180	180	0	175	170	5		1/4" foam, clarifier looks good. DO lowered from "50" to "45". Nearly all Bicarb and H2SO4 used…?
14	10/28/2003	180	180	0	170	170	0		looks good, clear. Reduced DO to "40"
15	10/29/2003	180	175	5	170	170	0		looks good!!
16	10/30/2003	175	125	50	170	140	30	500	Increased air to "42" from "37", looks good
17	10/31/2003	250	250	0	250	240	10	500	looks good, supernate slightly cloudy. **FEED SWITCHED TO 2947**
18	11/01/2003	250	250	0	240	225	15		heavy white foam with dark crust, floating solids in clarifier
19	11/02/2003	250	250	0	225	225	0		1 1/2" scummy foam, floating solid chunks in clarifier, clear supernate
20	11/03/2003	250	250	0	225	225	0	100	pH was too low, increased low setting, lowered air to "30", 2 drops 1/10 AF
21	11/04/2003	250	250	0	225	225	0		clear supernate, ~1" scummy foam in aerator, looks ok
22	11/05/2003	250	250	0	225	225	0		transparent supernate, 1/2" white foam with some scum coating, lowered air flow from "30" to "27"
23	11/06/2003	250	250	0	225	215	10		slightly turbid supernate, 1" white foam with scum coating
24	11/07/2003	250	250	0	215	200	15	100	1/2" scummy foam, turbid clarifier
25	11/08/2003	250	250	0	200	200	0		2" dark brown foam, bery turbid, 2 drops 1/10 AF
26	11/09/2003	250	250	0	200	200	0		1 1/2" foam with scum coating, scum on walls to 2", medium turbid supernate, decreased air from "28" to "2
27	11/10/2003	250	240	10	200	190	10	100	
28	11/11/2003	240			190	190	0		no foam, clear supernate
29	11/12/2003	off	off	off	190	190	0	100	very clear effluent, no foam, mixer off
30	11/13/2003			0	190	190	0		very clear effluent, increased stirring rate, no foam, decreased air flow
31	11/14/2003			0	190	190	0	100	same

		Chambers Works #1Control																
		FEED																
DAY	DATE	Feed DOC sol	COD tot	COD, sol	BOD, sol	NO2-N	NO3-N	NH3-N	TN, inst	TDS	SO4	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/L	mg/L	Calc		mg/L	mg/L	mg/L
32	11/15/2003																	
33	11/16/2003																	
34	11/17/2003	131				<1	1.5		23		569	6.2	7.5	1.3	5.1	<2.5	0.00	
35	11/18/2003	244							56	2133								
36	11/19/2003	241	916	826	478			25	53			5.4	6.7	1.3	5.2		0.00	
37	11/20/2003	218				<1	9.6		51		708					<2.5	0	
38	11/21/2003	242							51			4.7	6.8	2.2	8.6		0	
39	11/22/2003																	
40	11/23/2003																	
41	11/24/2003	252		742		3.53	7.06	25	55		873	3.8	6.1	2.3	9.1	<2.5	0	
42	11/25/2003	245							51	2033								
43	11/26/2003	245	853	808	478	6.66	3.15		49		840	3.8	8.0	4.2	16.7	<2.5	0	
44	11/27/2003																	
45	11/28/2003																	
46	11/29/2003																	
47	11/30/2003																	
48	12/01/2003	249		808		7.17	<.5		48		921					<2.5		
49	12/02/2003	218							36	2160								
50	12/03/2003	211	768	656	478				34			1.7	4.5	2.8	11.2		0	3.8
51	12/04/2003	152				<1	0.67	18			799					<2.5		
52	12/05/2003	144		516					12			4.1	5.7	1.6	6.4		0	
53	12/06/2003																	
54	12/07/2003																	
55	12/08/2003	125		451		<1	1.16		7		709	5.7	6.6	0.9	3.4	<2.5	0	
56	12/09/2003	118							6	1527								
57	12/10/2003	118	467	440	115				6			7.8	7.1	-0.7	-2.6		0	7.1
58	12/11/2003	108				<1	<.5	20	20		564					<2.50		
59	12/12/2003	121		401					19			6.8	7.3	0.6	2.2		0	
60	12/13/2003	121																
61	12/14/2003	121																

		Chambers Works #1 Control																			
		EFFLUENT																			
DAY	DATE	Eff 1 DOC	COD tot	Eff 1 COD, sol	Eff 1 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phosphonate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
32	11/15/2003																				
33	11/16/2003																				
34	11/17/2003	24					5	26	14		<1	9.86	651	2.52		3.2	0.68	2.7	<2.5	0	
35	11/18/2003	27					7			3793											
36	11/19/2003	31	167	96	7	3.63		26	12					2.8		4.4	1.6	6.4		0	
37	11/20/2003	37					20				<1	15.66	792	2.76					<2.5	0	
38	11/21/2003	41					23	15	8					2.8		4.8	2	8.0			
39	11/22/2003																				
40	11/23/2003																				
41	11/24/2003	85		251		14.22	31	45	41		<1	9.4	925	1.75		3.2	1.45	5.8	<2.5	0	
42	11/25/2003	76					31			2113											
43	11/26/2003	69	292	191	43		25	59	52		<1	3.97	907	1.46		3.2	1.74	7.0	<2.5		
44	11/27/2003																				
45	11/28/2003																				
46	11/29/2003																				
47	11/30/2003																				
48	12/01/2003	116		312			38	74	55		1.12	0.9	894	1.28					<2.5		
49	12/02/2003	96					34			2287											
50	12/03/2003	93	376	270	95		30	72	61					1.3		3	1.7	6.8			4.4
51	12/04/2003	93				15.79					<1	<.5	929	0.68					<2.5		
52	12/05/2003	87		301				73	58							2.5					
53	12/06/2003																				
54	12/07/2003																				
55	12/08/2003	50		133			3	60	44		<1	<.5	640	0.79		2.3	1.51	6.0	<2.5		
56	12/09/2003	45					1			1567											
57	12/10/2003	41	201	129	18		0							0.8		2.9	2.1	8.4			3.1
58	12/11/2003	38				5.4	0				<1	<.5	570						<2.5		
59	12/12/2003	35		113			0							0.8		5.9	5.1	20.4		0	
60	12/13/2003	38					4														
61	12/14/2003	46					7														

		Chambers Works #1 Control														
		UNIT PERFORMANCE														
					FEED VOL											
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR
		mg/L	mg/L	mL	L	L	L					mg/L		mL/L	mL/g	mg/L/hr
32	11/15/2003			3.8	13.8	10	3.8	2947	6.53	7.26	5.90	3.1	21.0			
33	11/16/2003			5.0	10	5	5	2947	6.73	7.24	6.11	3.3	21.2			
34	11/17/2003	9415	6401	3.3	5	0.8	4.2	2947	6.55	7.44	5.91	3.2	20.4			18.4
35	11/18/2003			4.0	4.6	0.2	4.4	2951	6.40	7.03		1.0	20.4			
36	11/19/2003	12972	8883	4.0	4.6		4.6	2951	6.30	7.14	5.42	1.2	20.4	220	17	16.3
37	11/20/2003			4.0	4.6	0.5	4.1	2951	6.38	7.17	6.23	4.3	20.3			
38	11/21/2003	9454	6440	4.5	4.6	0	4.6	2951	6.49	7.14	5.61	1.1	214.3			22.8
39	11/22/2003			4.1	4.6	0.2	4.4	2951								
40	11/23/2003			3.8	13.8		13.8	2951	6.59			1.7	22.0			
41	11/24/2003	8696	5998	4.1	10	6	4	2951	6.98	6.93	5.72		22.7			20.7
42	11/25/2003			3.8			0	2951	6.86	7.31	5.81	3.1	21.9			
43	11/26/2003	9313	6357	3.8	4.6	0	4.6	2951	6.86	7.15	5.86	4.1	20.3			14.2
44	11/27/2003				4.6	0.8	3.8	2951								
45	11/28/2003				18.4		18.4	2951								
46	11/29/2003			3.8			0	2951								
47	11/30/2003			4.1		13	-13	2951	7.16			5.2	20.8			
48	12/01/2003	10148	7094	4.0	13	8.2	4.8	2951	7.16	7.31	5.48	5.2	20.2			12.6
49	12/02/2003			4.0	4.6	0.8	3.8	2951-5	7.06	7.30	5.89		19.6			
50	12/03/2003	11492	7878	3.8	4.6	0.5	4.1	2951-5	6.85	7.37	6.09	4.4	21.7			10.2
51	12/04/2003			3.8	4.6	0	4.6	**37% 2954**	6.88	7.18	5.61	6.2	20.6			
52	12/05/2003	8920	6097	4.0	4.6	0.5	4.1	**100% 2954**	6.55	6.95	5.84	5.3	20.4	210	24	6.8
53	12/06/2003			4.7	13.8		13.8	2954	6.60							
54	12/07/2003			4.4		4.7	-4.7	2954	6.80	7.06	6.08	5.4	21.6			
55	12/08/2003	12244	8391	3.0	4.7	1	3.7	2954	7.26	7.32	5.86	6.0	20.6			7.1
56	12/09/2003			3.8	4.6	0.4	4.2	2954	6.96	6.95	5.82	4.6	20.9			
57	12/10/2003	11421	7821	4.2	4.6	0.7	3.9	2954	7.58	7.41	5.69	3.0	20.6	235	21	8.4
58	12/11/2003			3.4	4.6	0	0.1	2954	6.85	7.65	5.36	4.3	20.7			
59	12/12/2003	8731	6030	4.1	4.6	0.1	4.5	2954	6.90	7.64	6.27	3.7	20.7			10.58
60	12/13/2003			3.9	13.8	10	3.8	2954	6.57			2.4	21.0			
61	12/14/2003			4.9	10	4.9	5.1	2954	6.87			3.1	21.4			

									Chambers Works #1 Control
		pH controllers			pH controllers				
		INITIAL	FINAL	1.0N	INITIAL	FINAL	Bicarb		
DAY	DATE	1.0N H2SO4	1.0N H2SO4	H2SO4 con- sumed	Bicarb	Bicarb	con- sumed	Waste Vol	
		mL	mL	mL	mL	mL	mL	mL	COMMENTS
32	11/15/2003			0	190	175	15		same
33	11/16/2003			0	175	170	5		same (nearly clear effluent), slightly lowered pH control, lowered air from "20" to "18"
34	11/17/2003			0	170	170	0	50	slightly turbid, no foam, slight odor
35	11/18/2003			0	170	170	0		same--feed switched to 2951
36	11/19/2003			0	170	160	10	50	clear supernate, no foam
37	11/20/2003			0	160	160	0		same
38	11/21/2003			0	160	160	0	100	
39	11/22/2003			0	160	150	10		
40	11/23/2003			0	150	150	0		slightly turbid, no foam
41	11/24/2003			0	150	150	0		same, lowered pH control slightly
42	11/25/2003			0	150	150	0		slightly turbid, no foam
43	11/26/2003			0	150	150	0		same, lowered pH control slightly
44	11/27/2003			0	150	150	0		
45	11/28/2003			0	150	150	0		
46	11/29/2003			0	150	150	0		same
47	11/30/2003			0	150	150	0		same
48	12/01/2003			0	150	150	0		same, lowered air
49	12/02/2003			0	150	150	0		same, decreased air from "18"-"16" -- BEGAN FEEDING DRUM 5 FROM 2951
50	12/03/2003			0	150	150	0		turbid, no foam, decreased air from "15" to "14"
51	12/04/2003			0	150	150	0		SWITCHED FEED TO 37% 2954 -- turbid clarifier, no foam
52	12/05/2003			0	150	150	0		SWITCHED FEED ENTIRELY TO 2954 -- same, decreased air "15"-"13"
53	12/06/2003			0	150	150	0		same
54	12/07/2003			0	150	150	0		same, decreased air "15"-"10"
55	12/08/2003			0	150	150	0		same, decreased air "10"-"6"
56	12/09/2003			0	150	150	0		some turbidity, no foam
57	12/10/2003			0	150	150	0		turbid, no foam, pH too high, adjusted calibration
58	12/11/2003			0	150	150	0		turbid, no foam, lowered air "6" to "5" -- BEGAN ADDING 10 mg/L NH4Cl-N TO FEED FOR ALL REACTOR
59	12/12/2003			0	150	150	0		slightly turbid, no foam
60	12/13/2003			0	150	150	0		turbid, no foam
61	12/14/2003			0	150	150	0		same

		Chambers Works #1Control																
		FEED																
DAY	DATE	Feed DOC sol	COD tot	COD, sol	BOD, sol	NO2-N	NO3-N	NH3-N	TN, inst	TDS	SO4	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/L	mg/L	Calc		mg/L	mg/L	mg/L
62	12/15/2003	109		452		<1	<.5		19		573	7.7	7.6	-0.1	-0.4	<2.5	0	
63	12/16/2003	97							18	1713								
64	12/17/2003	113	433	368	263				19			6.0	6.8	0.8	3.3		0	6.7
65	12/18/2003	132				<1	6.94	24	34		1266					<2.5		
66	12/19/2003	189		658					55			0.2	6.6	6.4	25.5			
67	12/20/2003																	
68	12/21/2003											0.4	6.2	5.9	23.4			
69	12/22/2003	168	864	650		<1	14.26		53		1874					<2.5		
70	12/23/2003	191							57	5040								
71	12/24/2003																	
72	12/25/2003																	
73	12/26/2003	191			407	<1	14.56				1933					<2.5		
74	12/27/2003																	
75	12/28/2003																	
76	12/29/2003	185		694		<1	14.06		58		1825	0.5	1.1	0.6	2.6	<2.5		1.4
77	12/30/2003	162						28	47	5540								
78	12/31/2003	186	693	529	430				56			0.2	0.8	0.6	2.4			
79	01/01/2004																	
80	01/02/2004	182		480		<1	14.1		54		1842					<2.5		
81	01/03/2004																	
82	01/04/2004																	
83	01/05/2004	249		907		<1	<.5		51		2298	6.5	7.2	0.8	3.0	<2.5		
84	01/06/2004	260							51	7907								
85	01/07/2004	258	876	891	470			29	51			4.2	5.1	0.9	3.6			
86	01/08/2004	258																
87	01/09/2004																	

		Chambers Works #1 Control																			
		EFFLUENT																			
DAY	DATE	Eff 1 DOC	COD tot	Eff 1 COD, sol	Eff 1 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phosphonate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
62	12/15/2003	32		114			5				<1	<.5	622	2.09		4.2	2.11	8.4	<2.5	0	
63	12/16/2003	32					6			1667											
64	12/17/2003	31	136	31	15		4	77	58							3.3	3.3	13.2			5.0
65	12/18/2003	34		100		12.08	9				<1	<.5	597	2.47					<2.5	0	
66	12/19/2003	31		104			18	61	44							4.8	4.8	19.2			
67	12/20/2003																				
68	12/21/2003																				
69	12/22/2003	27	128	168			25	48	34		<1	1.05	1834	<1		0.9	0.9	3.6	<2.5	0	
70	12/23/2003	30					36														
71	12/24/2003																				
72	12/25/2003																				
73	12/26/2003	28		110	15		42	22	9		<1	1	1964	<1		0.5	0.5	2.0	<2.5	0	
74	12/27/2003																				
75	12/28/2003																				
76	12/29/2003	22		118			42	25	13		<1	4.13	1924	<1		0.8	0.8	3.2	<2.5	0	0.6
77	12/30/2003	28				26.82	44			5920											
78	12/31/2003	30	161	134	14		38	36	21							0.8	0.8	3.2			
79	01/01/2004																				
80	01/02/2004	32		67			42	38	22		<1	2.35	1851	<1		0.7	0.8	3.2	<2.5		
81	01/03/2004	46					58														
82	01/04/2004	44					47														
83	01/05/2004	42		172			45	73	46		<1	<.5	2003			1.6	0.8	3.2	<2.5		
84	01/06/2004	46					42			6553											
85	01/07/2004	51	247	221	15	28.28	43	83	34							1.6	0.8	3.2	<2.5		
86	01/08/2004	46					35				<1	<.5	2615	<1					<2.5		
87	01/09/2004																				

		Chambers Works #1 Control														
		UNIT PERFORMANCE														
					FEED VOL											
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR
		mg/L	mg/L	mL	L	L	L					mg/L		mL/L	mL/g	mg/L/hr
62	12/15/2003	11060	7614	3.8	4.9	0.5	4.4	2954	6.89	7.28	5.72	4.2	20.9			9.6
63	12/16/2003			4.0	4.6	0	4.6	2954	6.81	7.50	5.48	3.4	20.9			
64	12/17/2003	10691	7471	4.1	4.6	0.6	4	2954	6.68	7.52	5.88	2.4	21.3			5.7
65	12/18/2003			4.0	4.6	0.2	4.4	50% 2959	6.58	7.46	5.88	2.4	20.2			
66	12/19/2003	11460	8026	3.1	5	0.5	4.5	2959	6.78	7.44		0.5	20.9			11.8
67	12/20/2003			4.0	13.8	9.8	4	2959	7.30			1.2	21.8			
68	12/21/2003			5.1	9.8	4.9	4.9	2959	6.65			1.2	21.7			
69	12/22/2003	12759	8941	3.5	4.9	0.5	4.4	2959	6.59	7.14	5.91	0.7	20.6			9.8
70	12/23/2003			4.2	4.6	0	4.6	2959	6.45	6.96		2.5	21.3			
71	12/24/2003			5.7	13.8	8	5.8	2959								
72	12/25/2003				8	4	4	2959								
73	12/26/2003	12223	8509	6.3	4	1.5	2.5	2959	6.63	6.86	5.94	2.7	21.9			13.6
74	12/27/2003			4.3	13.8	8.5	5.3	2959	6.33	6.67		2.6	22.2			
75	12/28/2003			5.2	8.5	3.3	5.2	2959	6.50	6.76	6.14	2.2	22.4			
76	12/29/2003	10820	7428	2.3	3.3	0.6	2.7	2959	6.70	6.85	5.41	5.3	22.2	250	23	13.4
77	12/30/2003			4.5	4.6	0.7	3.9	2959	6.54	6.98	5.29	0.7	21.8			
78	12/31/2003	11256	7753	4.0	4.6	0			6.62	6.95	5.57	2.0	21.9			15.2
79	01/01/2004				9.2											
80	01/02/2004	12201	8259	7.1		2			6.71	6.89	5.46	1.8	22.2			19.2
81	01/03/2004			5.0	13.8	8.4			6.83	7.35		0.0	22.5			
82	01/04/2004			4.8	8.4	3.9			6.93	7.52	6.61	3.4	22.8			
83	01/05/2004	10704	7296	2.8	3.9	0.2			7.07	7.52	5.56	3.9	22.0	270	25	14.7
84	01/06/2004			2.1	4.6	1			7.18	7.51		5.9	21.6			
85	01/07/2004	11171	7610	4.3	4.6	0			7.08	7.55	6.83	5.0	21.2			15.7
86	01/08/2004			4.3	4.6	0.5			7.42	7.56		6.9	21.8			
87	01/09/2004															

									Chambers Works #1 Control
		pH controllers			pH controllers				
		INITIAL	FINAL	1.0N	INITIAL	FINAL	Bicarb		
DAY	DATE	1.0N H2SO4	1.0N H2SO4	H2SO4 con-sumed	Bicarb	Bicarb	con-sumed	Waste Vol	
		mL	mL	mL	mL	mL	mL	mL	COMMENTS
62	12/15/2003			0	150	150	0		same
63	12/16/2003			0	150	150	0		same, aerator not mixing well
64	12/17/2003			0	150	140	10		Turbid, no foam
65	12/18/2003			0	140	140	0		SWITCHED FEED TO 50% 2959 (NOT adding NH4Cl to new tote) --
66	12/19/2003			0	140	140	0		SWITCHED FEED ENTIRELY TO 2959 --
67	12/20/2003			0	140	110	30		Turbid, adj pH
68	12/21/2003			0	110	110	0		Medium turbidity, no foam
69	12/22/2003			0	110	110	0		Sl turbid, dk yellow supernate. No foam, not mixing well
70	12/23/2003				110	110	0		Same
71	12/24/2003				110	110	0		Turbid
72	12/25/2003				110	110	0		
73	12/26/2003				110	110	0		
74	12/27/2003				110	110	0		Turbid clar. Yellow/orange crust on Rx walls
75	12/28/2003				110	110	0		30% settled solids. Effluent turbidity similar to Unit B
76	12/29/2003				110	110	0		Clear super, looks great
77	12/30/2003				110	110	0		Murky, looks good. Increased air
78	12/31/2003					110			turbid, no odor
79	01/01/2004					110			
80	01/02/2004					100			start 30% drum 2966-1. Murky, thin brownish foam
81	01/03/2004					100			dark turbid, crusty film in aerator, inc air to '20'
82	01/04/2004					100			30% settled solids in clarifier and supernate is more turbid then unit B
83	01/05/2004					100			start 100% drum 2966-1. V.turbid & dark, no foam
84	01/06/2004					100			v turbid, dark, thin brown foam
85	01/07/2004					100			sl.turbidity, fairly clear, lite yellow supernate
86	01/08/2004					100			pH a bit high, bit more turbid today, thin foam. Eff saved for toxicity testing
87	01/09/2004								**1/8 end of test. Rxs sacrificed for odor panel and cakes**

		Chambers Works #2 NPSBC																		
		FEED																		
		(Neutralized, Preferred, Stripped, Base case, DCC)																		
DAY	DATE	Feed DOC sol	COD tot	COD, sol	BOD, sol	NO2-N	NO3-N	NH3-N	TN, inst	TDS	SO4	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P	DAY	DATE
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/L	mg/L	Calc		mg/L	mg/L	mg/L		
1	10/15/2003																		1	10/15/2003
2	10/16/2003	372							97										2	10/16/2003
3	10/17/2003	358		932	589				81			8.1							3	10/17/2003
4	10/18/2003																		4	10/18/2003
5	10/19/2003																		5	10/19/2003
6	10/20/2003	348	1313	1030					76			7.9							6	10/20/2003
7	10/21/2003	331							111								0		7	10/21/2003
8	10/22/2003	333		1156	547				109	2260		6.2	7.3	1.1	4.4		0		8	10/22/2003
9	10/23/2003	258							67										9	10/23/2003
10	10/24/2003	419		1256		<1	<.5	28.30	103		1646	4.6	20.2	11.6	46.4	12	4.01		10	10/24/2003
11	10/25/2003																		11	10/25/2003
12	10/26/2003																		12	10/26/2003
13	10/27/2003	323	1529	1047		<1	<.5		91		1593	4.6	20.4	12.4	49.6	10.59	3.42	25.0	13	10/27/2003
14	10/28/2003	230							63	2820									14	10/28/2003
15	10/29/2003	274		1292	509	<1	<.5		72		1614.19	3.6	22.8	15.6	62.3	11.38	3.67		15	10/29/2003
16	10/30/2003	382							86										16	10/30/2003
17	10/31/2003	244				3.76	<.5		49		1436.35	5.6	20.3	11.4	45.8	10.03	3.24		17	10/31/2003
18	11/01/2003																		18	11/01/2003
19	11/02/2003																		19	11/02/2003
20	11/03/2003	244	820	636		17.03	<.5		55		759.77	2.6	18.4	12.1	48.6	11.28	3.64		20	11/03/2003
21	11/04/2003	234							49	3840									21	11/04/2003
22	11/05/2003	243		728	217				49				23.0						22	11/05/2003
23	11/06/2003	247				12.11	<.5	15.60	47		626.33					11.72	3.78		23	11/06/2003
24	11/07/2003	241							43			3.6	23.0	15.7	62.7		3.78		24	11/07/2003
25	11/08/2003																		25	11/08/2003
26	11/09/2003																		26	11/09/2003
27	11/10/2003	224	828	721		<1	<.5		39		677	3.5	23.0	15.9	63.4	11	3.61		27	11/10/2003
28	11/11/2003	207							30	3773									28	11/11/2003
29	11/12/2003	240		648	482				29			3.5	20.4	13.5	54.1	10	3.34		29	11/12/2003
30	11/13/2003	165		604		<1	<.5	12	55		743					10			30	11/13/2003
31	11/14/2003	197							49			3.4	18.7	12.0	48.0	10	3.34		31	11/14/2003

		EFFLUENT																			
														0.9=BDL							
DAY	DATE	Eff 2 DOC	COD tot	Eff 2 COD, sol	Eff 2 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phosphonate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
1	10/15/2003																				
2	10/16/2003	35					52														
3	10/17/2003	35		132	7		63	43	31		<1	<.5	1709	1.15	1.15				<2.5		
4	10/18/2003																				
5	10/19/2003																				
6	10/20/2003	41	127	66			53	19	17		<1	0.98	1561	1.23	2.3				<2.5		
7	10/21/2003	36					57													0	
8	10/22/2003	33		96			77	22	16	3293	<1	6.54	1542	1.33	1.5	2.3	0.97	3.9	<2.5	0	
9	10/23/2003	65					80														
10	10/24/2003	36		160		28.1	74	22	14		<1	10.27	1566	1.3					<2.5	0	
11	10/25/2003																				
12	10/26/2003																				
13	10/27/2003	51	257	196			39	25	18		1.18	11.22	1627	1.3		14.5	9.74	39.0	10.71	3.46	17.6
14	10/28/2003	61					39			2860											
15	10/29/2003	64		181	16			42	29		2.91	16.01	1595	1.69	1.89	14.6	9.03	36.1	12.03	3.88	
16	10/30/2003	89					38														
17	10/31/2003	79					61	45	32		2.53	13.19	1596	1.49		12.1	6.73	26.9	12.02	3.88	
18	11/01/2003																				
19	11/02/2003																				
20	11/03/2003	89	152	109			40	29	21		2.6	7.28	1454	0.88		12.8	6.96	27.8	15.37	4.96	
21	11/04/2003	81					37			3360											
22	11/05/2003	70		280	13		32	35	22							14.3	14.30	57.2			
23	11/06/2003	69				2.35	29				<1	21.37	751	2.4					24.97	8.06	
24	11/07/2003	66					29	43	27							16.8	8.74	35.0		8.06	
25	11/08/2003																				
26	11/09/2003																				
27	11/10/2003	77	386	226			41	65	28		<1	26.44	719	3.64		17.4	2.20	8.8	35.81	11.56	
28	11/11/2003	87					38			3520											
29	11/12/2003	81		248	8		32	95	64					3.6		16.9	1.57	6.3	36.34	11.73	
30	11/13/2003	83		196		3.36	31				<1	24.71	722						36.34	11.73	
31	11/14/2003	71					25	84	50					3.1		16.5	1.67	6.7	36.34	11.73	

		Chambers Works #2 NPSBC														
		UNIT PERFORMANCE														
					FEED VOL											
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR
		mg/L	mg/L	L	L	L	L					mg/L		mL/L	mL/g	mg/L/hr
1	10/15/2003								7.29			3.3	23.1			
2	10/16/2003			4.2	4.6	0	4.6	2941	7.43	7.96	5.46	0.1	22.7			
3	10/17/2003	13110	8287	4.6	4.6	0	4.6	2941	7.39	7.97	5.65	1.1	22.8			46.1
4	10/18/2003			5.7	14.6	9.2	5.4	2941	7.43	7.95	5.92	0.5	19.3			
5	10/19/2003			5.1	9.2	3.6	5.6	2941	7.36	7.79	6.17	0.4	20.2			
6	10/20/2003	12189	7556	3.3	3.6	0	3.6	2941	7.33	7.91	6.02	3.1	20.2			30.4
7	10/21/2003			4.2	4.6	0.2	4.4	2941	7.16	7.88	5.97	2.0	19.2			
8	10/22/2003	13164	8487	4.4	4.6	0	4.6	2941	7.11	7.93	5.60	5.8	20.4			39.8
9	10/23/2003			4.5	4.6	0.2	4.4	2941	7.13	7.76	5.60	1.7	22.0			
10	10/24/2003	11543	7510	3.9	4.6	0.8	3.8	2941	6.72	7.75	5.72	2.9	22.3			47.6
11	10/25/2003			5.6	14.1	8.2	5.9	2941	6.87			1.0	22.8			
12	10/26/2003			4.7	8.2	3.75	4.45	2941	6.55	7.61	6.26	5.9	21.3			
13	10/27/2003	14203	9442	3.4	3.75	0.5	3.25	2941	6.32	7.49	6.15	6.8	20.8			42.8
14	10/28/2003			4.4	4.6	0.2	4.4	2941	6.27	7.40		4.9	22.1			
15	10/29/2003	12465	8292	4.4	4.6	0	4.6	2941	6.41	7.38	6.19	5.2	22.1			50.8
16	10/30/2003			4.4	4.6	0.2	4.4	2941	6.39	7.20	6.39	6.4	21.9			
17	10/31/2003	14530	9870	3.9	4.6	0.8	3.8	2941	6.17	7.23	6.17	4.6	22.3	220		51.1
18	11/01/2003			5.1	13.8	8.6	5.2	2941	6.30	6.71	6.25	6.3	21.8			
19	11/02/2003			5.0	8.6	3.8	4.8	2941	7.03	7.17	6.25	7.4	21.4			
20	11/03/2003	11531	7947	2.6	3.8	0.5	3.3	**2947-1a**	6.04	7.12	6.04	6.5	21.5			26.6
21	11/04/2003			3.8	4.6	0.8	3.8	**2947-1b**	6.31	7.18	5.58	6.1	21.2			
22	11/05/2003	12686	8813	4.5	4.6	0.2	4.4	2947-1b	6.41	6.92	5.63	5.1	21.5		0	28.5
23	11/06/2003			4.0	4.6	0.8	3.8	2947-1b	6.35	6.80	5.72	5.0	21.3			
24	11/07/2003	13416	9130	4.6	4.6	0	4.6	**2947-1c (60%)**	6.17	6.72		4.7	22.2	220		29.8
25	11/08/2003			5.1	13.8	8.8	5	2947-1c 60%	6.42	6.61	5.95	5.2	22.1			
26	11/09/2003			4.4	8.8	4	4.8	2947-1c 60%	6.29		5.80	4.4	23.5			
27	11/10/2003	12242	8201	3.8	4	0	4	**2947-1c**	6.22	6.61	5.78	5.0	23.7			24.6
28	11/11/2003			4.3	4.6	0	4.6	**2947-1d 50%**	6.21	6.54	6.20	5.1	23.4			
29	11/12/2003	12622	8435	4.5	4.6	0	4.6	2947	6.39	6.88	6.21	4.1	21.7	215	17	21.8
30	11/13/2003			4.2	4.6	0	4.6	2947	6.43	6.90	5.58	3.8	21.0			
31	11/14/2003	9241	6098	3.8	4.6	1	3.6	2947	6.28	6.85	6.41	4.8	22.7			17.4

						Chambers Works #2 NPSBC
		pH controllers				
		INITIAL	**FINAL**	**Bicarb**		
DAY	**DATE**	**Bicarb**	**Bicarb**	**con-sumed**	**Waste Vol**	
		mL	**mL**	**mL**	**mL**	**COMMENTS**
1	10/15/2003					See #1 comments
2	10/16/2003	250	250	0		Turbid super, looks good. Inc air
3	10/17/2003	250	250	0		Same
4	10/18/2003	250	250	0		Increased DO to 400. Rx looks good. Need to lower rx pH.
5	10/19/2003	250	250	0		Increased DO to 500, same
6	10/20/2003	250	250	0		Looks good
7	10/21/2003	250	240	10		Looks good
8	10/22/2003	240	240	0		looks good, DO lowered to "425"
9	10/23/2003	240	240	0		looks good, supernate clear (brown purple color)
10	10/24/2003	240	240	0		supernate a little cloudier, still looks good, STARTED FEEDING NCH (4.9mL NPBS/4.6mL Feed)
11	10/25/2003	240	240	0		Lowered feed rate. Slight foam, turbid clar., Increased air to "700"
12	10/26/2003	240	240	0		Some floating solids in clar., 3/4" grey foam.
13	10/27/2003	240	240	0		Thin foam in aerator, some floating solids in clar.
14	10/28/2003	240	240	0		Clarifier still turbid, thin foam/scum in aerator.
15	10/29/2003	240	240	0		floating sludge, 1/2" white foam w/ scum on walls of aerator, supernate slightly cloudy
16	10/30/2003	240	240	0	250	lowered air from "575" to "525", 1/2" foam, clear supernate
17	10/31/2003	240	240	0		slightly turbid clarifier, thin foam, looks good overall
18	11/01/2003	240	240	0		1/2" foam in aerator, clarifier 50% full of solids, looks ok
19	11/02/2003	240	240	0		1 1/2" dense white foam, supernate clear, 80% solids in clarifier
20	11/03/2003	240	240	0	100	pH too low, increased low pH controller, lowered air flow to "300", only about 1/2" foam, clean supernate, Rx looks good, **feed switched to 2947**
21	11/04/2003	240	240	0		looks good, clear supernate, 1/4" white foam with scummy coating
22	11/05/2003	240	230	10		slightly turbid supernate, some scummy foam
23	11/06/2003	230	230	0	100	same
24	11/07/2003	230	225	5	100	slightly turbid supernate (slightly more than yesterday), thin scummy foam
25	11/08/2003	225	225	0		1/2" foam with scummy edges, turbid supernate
26	11/09/2003	225	225	0		1" scummy foam, turbid supernate
27	11/10/2003	225	225	0	100	some floating solid chunks in turbid supernate, 1" scummy foam in aerator
28	11/11/2003	225	225	0		1" foam coated in scum, turbid clarifier, decreased air from "500" to "400"
29	11/12/2003	225	210	15	100	1/4" scummy foam, turbid
30	11/13/2003	210	200	10		1/2" scummy foam, clarifier turbid
31	11/14/2003	200	200	0	100	slightly less turbid, very scummy foam

		Chambers Works #2 NPSBC																
		FEED																
		(Neutralized, Preferred, Stripped, Base case, DCC)																
DAY	**DATE**	**Feed DOC sol**	**COD tot**	**COD, sol**	**BOD, sol**	**NO2-N**	**NO3-N**	**NH3-N**	**TN, inst**	**TDS**	**SO4**	**PO4-P, Hach**	**Phos-phon-ate-P**	**EMPA-P**	**EMPA**	**MPA**	**MPA-P**	**Total P**
		mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/l**	**mg/L**	**mg/L**	**Calc**		**mg/L**	**mg/L**	**mg/L**
32	11/15/2003																	
33	11/16/2003																	
34	11/17/2003	167				<1	1.49		28		647	5.8	21.8	12.7	50.7	10	3.34	
35	11/18/2003	271							58	2093								
36	11/19/2003	289	1035	940	536			28	60			4.5	21.2	13.4	53.6	10	3.34	
37	11/20/2003	265				<1	9.62		56		789					9	3.05	
38	11/21/2003	282							56			2.3	15.6	10.4	41.4		3.00	
39	11/22/2003																	
40	11/23/2003																	
41	11/24/2003	289		925		3.48	6.95	27	58		907	3.6	16.5	9.7	38.9	10	3.19	
42	11/25/2003	273							53	2193								
43	11/26/2003	268	1126	869	536	7.72	<.5		50		908	3.6	17.1	11.1	44.4	7	2.41	
44	11/27/2003																	
45	11/28/2003																	
46	11/29/2003																	
47	11/30/2003																	
48	12/01/2003	315		992		7.81	<.5		57		1054					13	4.10	
49	12/02/2003	257							41	2473								
50	12/03/2003	247	1044	744	536				38			2.2	16.2	9.9	39.7		4.10	16.8
51	12/04/2003	175				<1	0.66	20			841					5	1.50	
52	12/05/2003	151		592					14			4.5	16.1	11.6	46.3			
53	12/06/2003																	
54	12/07/2003																	
55	12/08/2003	165		562		<1	1.16		12		824	5.2	21.4	12.4	49.5	12	3.79	
56	12/09/2003	154							11	1680								
57	12/10/2003	144	540	537	136				10			7.0	19.4	8.6	34.5		3.80	19.8
58	12/11/2003	138				<1	<.5	22	24		631					11	3.46	
59	12/12/2003	158		502					24			6.2	20.2	10.7	42.6		3.40	
60	12/13/2003	158																
61	12/14/2003	158																

		Chambers Works #2 NPSBC																			
		EFFLUENT																			
														0.9=BDL							
DAY	DATE	Eff 2 DOC	COD tot	Eff 2 COD, sol	Eff 2 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phosphonate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
32	11/15/2003																				
33	11/16/2003																				
34	11/17/2003	58		204			40	53	33		<1	38.96	717	2.78		15.5	1.72	6.9	34.07	11.00	
35	11/18/2003	63					34			4233											
36	11/19/2003	67	242	158	13	8.19	32	40	24					3.1		16.4	2.30	9.2	34.07	11.00	
37	11/20/2003	69					30				<1	16.15	850	3.09					35.07	11.32	
38	11/21/2003	77					30	22	18					3.09		15.6	1.21	4.8		11.30	
39	11/22/2003																				
40	11/23/2003																				
41	11/24/2003	92		259		16.88	32	51	44		<1	4.65	945	1.3		14.7	2.94	11.8	32.39	10.46	
42	11/25/2003	101					37			2020											
43	11/26/2003	99	444	290	70		33	89	71		<1	3.58	956	1.31		15.6	6.01	24.0	25.64	8.28	
44	11/27/2003																				
45	11/28/2003																				
46	11/29/2003																				
47	11/30/2003																				
48	12/01/2003	119		309			38	100	73		1.29	<.5	961	1.2					23.15	7.48	
49	12/02/2003	115					32			2473											
50	12/03/2003	117	454	331	100		30	81	61							15.2	7.00	28.0		8.20	16.8
51	12/04/2003	124				17.67	34				<1	<.5	1010						25.27	8.16	
52	12/05/2003	111		353			26	162	113							14.6					
53	12/06/2003																				
54	12/07/2003																				
55	12/08/2003	73		208			5	102	69		<1	<.5	734	1.4		14.4	4.20	16.8	27.24	8.80	
56	12/09/2003	66					2			1653											
57	12/10/2003	63	288	175	5		0									15.7	5.50	22.0		10.20	16.7
58	12/11/2003	67				5.1	0				<1	<.5	667	2.44					31.49	10.17	
59	12/12/2003	63		182			2							2.4		17.9	5.30	21.2		10.20	
60	12/13/2003	65					8														
61	12/14/2003	69					16														

		Chambers Works #2 NPSBC														
		UNIT PERFORMANCE														
					FEED VOL											
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR
		mg/L	mg/L	mL	L	L	L					mg/L		mL/L	mL/g	mg/L/hr
32	11/15/2003			3.8	13.8	10	3.8	2947	6.48	6.81	5.93	4.1	22.5			
33	11/16/2003			5.7	10	4	6	2947	6.31	6.90	6.04	4.6	22.2			
34	11/17/2003	10669	7107	1.8	4	2	2	2947	6.55	7.30	6.66	3.3	21.2			21.8
35	11/18/2003			2.9	4.6	0	4.6	**2951**	6.48	7.19	5.68	0.5	21.4			
36	11/19/2003	8167	5377	4.4	4.6	0	4.6	2951	6.56	7.19	5.55	2.1	21.1	200	24	22.3
37	11/20/2003			4.3	4.6	0	4.6	2951	6.56	7.16	5.77	3.2	20.7			
38	11/21/2003	8260	5474	4.8	4.6	0	4.6	2951	6.52	7.08	6.42	2.7	21.9			22.1
39	11/22/2003			4.6	13.8		13.8	2951								
40	11/23/2003			4.0	9.5	5	4.5	2951	6.87			2.1	23.0			
41	11/24/2003	7679	5163	4.7	5	0	5	2951	7.42	7.54	5.73		23.7			24.6
42	11/25/2003			4.3	4.6	0.5	4.1	2951	7.13	7.49	5.96		23.2			
43	11/26/2003	9031	6011	4.5	4.6	0	4.6	2951	6.91	7.36	5.80	4.8	21.9	210		27.5
44	11/27/2003				18.4		18.4	2951				2.5				
45	11/28/2003						0	2951				2.1				
46	11/29/2003			4.0		4.2	-4.2	2951	7.25			5.2	22.1			
47	11/30/2003			4.2	4.2	0	4.2	2951	7.41			6.7	22.0			
48	12/01/2003	8866	6039	4.5	4.6	0	4.6	2951	6.48	7.39	5.76	5.3	21.6			17.9
49	12/02/2003			4.5	4.6	0	4.6	2951-5	7.03	7.28	5.95	5.4	21.3			
50	12/03/2003	10522	7113	4.2	4.6	0	4.6	2951-5	6.73	7.14	6.28	5.3	23.3	170		13
51	12/04/2003			4.5	4.6	0	4.6	**37% 2954**	6.82	7.03		6.3	21.6			
52	12/05/2003	13415	9092	4.0	4.6	0	4.6	**2954**	6.72	6.85	5.83	6.0	21.6		0	10.3
53	12/06/2003			5.0	13.8		13.8	2954	6.74							
54	12/07/2003			4.5		4	-4	2954	6.79	6.95	6.07	6.2	21.8			
55	12/08/2003	11495	7771	3.8	4	0	4	2954	6.69	7.22		5.1	21.4			9.9
56	12/09/2003			4.2	4.6	0.1	4.5	2954	6.53	7.03	5.89	4.4	21.4			
57	12/10/2003	10806	7160	4.2	4.6	0	4.6	2954	6.66	7.05	5.56	5.2	21.5		0	10.2
58	12/11/2003			4.5	4.6	0	4.6	2954	6.58	7.01	6.23	4.7	21.1			
59	12/12/2003	10396	6428	4.6	4.6	0	4.6	2954	6.53	6.97	6.31	1.7	21.4			9.7
60	12/13/2003			4.0	13.8	10	3.8	2954	6.54			2.7	21.5			
61	12/14/2003			5.0	10	4.2	5.8	2954	6.58			1.8	21.8			

						Chambers Works #2 NPSBC
		pH controllers				
		INITIAL	FINAL	Bicarb		
DAY	DATE	Bicarb	Bicarb	con-sumed	Waste Vol	
		mL	mL	mL	mL	COMMENTS
32	11/15/2003	200	190	10		turbid clarifier, 1" scummy foam, added 1 drop 1/10 AF
33	11/16/2003	190	175	15		lowered air from "400" to "300", same appearance, corrected pH setting, added 2 drops 1/10 AF
34	11/17/2003	175	175	0	50	1" scummy foam, turbid supernate
35	11/18/2003	175	170	5		1/2" scummy foam, turbid -- Switched feed to 2951
36	11/19/2003	170	160	10	50	slightly turbid, no foam
37	11/20/2003	160	150	10		same
38	11/21/2003	150	150	0	50	same
39	11/22/2003	150	150	0		slightly turbid, thin scummy foam
40	11/23/2003	150	150	0		same
41	11/24/2003	150	150	0		slightly turbid, no foam
42	11/25/2003	150	150	0		slightly turbid, 1/2" scummy foam
43	11/26/2003	150	150	0		turbid, 1" scummy foam
44	11/27/2003	150	150	0		
45	11/28/2003	150	150	0		
46	11/29/2003	150	150	0		same
47	11/30/2003	150	150	0		same
48	12/01/2003	150	150	0		same
49	12/02/2003	150	150	0		turbid, 1/2" scummy foam -- BEGAN FEEDING DRUM 5 FROM 2951
50	12/03/2003	150	150	0		turbid, 1" scummy foam
51	12/04/2003	150	150	0		SWITCHED FEED TO 37% 2954 -- less turbid, no foam, not stirring, fixed mixer
52	12/05/2003	150	150	0		SWITCHED FEED ENTIRELY TO 2954 -- turbid, no foam
53	12/06/2003	150	150	0		same
54	12/07/2003	150	150	0		same, decreased air "200"-"116"
55	12/08/2003	150	150	0		turbid, no foam
56	12/09/2003	150	150	0		turbid, no foam
57	12/10/2003	150	150	0		turbid, thin brown foam
58	12/11/2003	150	150	0		turbid, no foam - lowered air "40" to "30" -- BEGAN ADDING 10 mg/L NH4Cl-N TO FEED FOR ALL REACTORS
59	12/12/2003	150	150	0		turbid, no foam
60	12/13/2003	150	150	0		same
61	12/14/2003	150	150	0		same

		Chambers Works #2 NPSBC																
		FEED																
		(Neutralized, Preferred, Stripped, Base case, DCC)																
DAY	**DATE**	**Feed DOC sol**	**COD tot**	**COD, sol**	**BOD, sol**	**NO2-N**	**NO3-N**	**NH3-N**	**TN, inst**	**TDS**	**SO4**	**PO4-P, Hach**	**Phos-phon-ate-P**	**EMPA-P**	**EMPA**	**MPA**	**MPA-P**	**Total P**
		mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/l**	**mg/L**	**mg/L**	**Calc**		**mg/L**	**mg/L**	**mg/L**
62	12/15/2003	160		514		<1	<.5		26		634	6.6	21.3	12.1	48.4	8	2.60	
63	12/16/2003	142							24	1847								
64	12/17/2003	152	529	452	317				25			5.1	20.6	12.9	51.6		2.60	19.7
65	12/18/2003	177				<1	6.87	28	41		1333					7	2.35	
66	12/19/2003	239		793					59			0.5	14.0	11.2	44.8		2.30	
67	12/20/2003																	
68	12/21/2003																	
69	12/22/2003	224	861	831		<1	14.15		59		1926	1.7	14.9	12.2	48.6	3	1.01	
70	12/23/2003	241							62	5307								
71	12/24/2003																	
72	12/25/2003																	
73	12/26/2003	241			389	<1	14.29				1967					4	1.22	
74	12/27/2003																	
75	12/28/2003																	
76	12/29/2003	228		796		<1	14.13		66		1905	0.6	14.5	12.5	50.0	4	1.41	15.4
77	12/30/2003	208						32	52	5427								
78	12/31/2003	241	987	638	463				62			0.6	14.0	13.5	53.8			
79	01/01/2004																	
80	01/02/2004	246		612		<1	14.14		61		1917					2	0.74	
81	01/03/2004																	
82	01/04/2004																	
83	01/05/2004	315		1048		<1	<.5		61		2385	4.4	22.1	15.7	62.8	6	2.01	
84	01/06/2004	329							62	8553								
85	01/07/2004	312	1372	1043	463				59			1.9	21.0	19.1	76.4			
86	01/08/2004	312																
87	01/09/2004																	

		Chambers Works #2 NPSBC																			
		EFFLUENT																			
														0.9=BDL							
DAY	DATE	Eff 2 DOC	COD tot	Eff 2 COD, sol	Eff 2 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phosphonate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
62	12/15/2003	73		208			17				<1	<.5	727	3.2		19.4	4.75	19.0	35.47	11.45	
63	12/16/2003	59					14			1553											
64	12/17/2003	60	231	118	14		12	87	60							14.8	3.40	13.6		11.40	17.5
65	12/18/2003	68				13.89	14				<1	<.5	653	3.1					30.6	9.88	
66	12/19/2003	68		211			22	84	58							16.9	16.90	67.6			
67	12/20/2003																				
68	12/21/2003																				
69	12/22/2003	81	259	265			36	65	51		<1	<.5	1873	0.9		11.9	6.53	26.1	13.85	4.47	
70	12/23/2003	95					40														
71	12/24/2003																				
72	12/25/2003																				
73	12/26/2003	91		276	60		48	41	30		<1	1.05	2009	0.9		11.5	8.69	34.7	5.93	1.91	
74	12/27/2003																				
75	12/28/2003																				
76	12/29/2003	80		300			53	75	42		<1	6.18	2064	0.9		13.2	10.58	42.3	5.33	1.72	13.4
77	12/30/2003	87				28.22	60			5880											
78	12/31/2003	90	313	235	38		52	24	15							14.1	14.10	56.4			
79	01/01/2004																				
80	01/02/2004	87		179			55	30	16		4.33	10.11	1942	0.9		14.2	11.63	46.5	5.18	1.67	
81	01/03/2004	93					60														
82	01/04/2004	91					49														
83	01/05/2004	93		319			48	86	53		<1	4.3	2090	0.9		13.8	10.56	42.2	7.25	2.34	
84	01/06/2004	93					47			6613											
85	01/07/2004	95	375	273	31	29.58	45	115	53							14.9	12.56	50.2	7.25	2.34	
86	01/08/2004	85					42				1.19	<.5	2727	<1					38.27		
87	01/09/2004																				

		Chambers Works #2 NPSBC														
		UNIT PERFORMANCE														
					FEED VOL											
DAY	**DATE**	**MLSS**	**MLVSS**	**EFF VOL**	**INITIAL**	**FINAL**	**FEED USED**	**Drum ID**	**UNIT pH**	**EFF pH**	**FEED pH**	**DO**	**TEMP ºC**	**SSV**	**SVI**	**OUR**
		mg/L	**mg/L**	**mL**	**L**	**L**	**L**					**mg/L**		**mL/L**	**mL/g**	**mg/L/hr**
62	12/15/2003	10358	7144	3.9	4.2	0	4.2	2954	6.59	7.04	5.68	1.5	21.8			9
63	12/16/2003			4.2	4.6	0.5	4.1	2954	6.54	7.06	5.52	3.2	21.7			
64	12/17/2003	11334	7930	4.0	4.6	0.5	4.1	2954	6.47	7.07	5.41	1.5	21.7			10.2
65	12/18/2003			4.0	4.6	0	4.6	**50% 2959**	6.42	6.99	5.76	2.0	20.6			
66	12/19/2003	11567	8080	3.0	4.6	0.7	3.9	**2959**	6.45	7.11	5.47	1.9	21.5			16.1
67	12/20/2003			3.4	13.8	10.3	3.5	2959	6.23			1.2	22.1			
68	12/21/2003			4.7	10.3	6	4.3	2959	6.55			4.2	21.9			
69	12/22/2003	10330	7219	3.3	6	2	4	2959	6.49	6.87	5.47	4.0	21.6			14.8
70	12/23/2003			4.4	4.6	0	4.6	2959	6.66	6.79	5.69	6.2	21.9			
71	12/24/2003			6.0	13.8	8	5.8	2959	6.41	6.41						
72	12/25/2003				8	4	4	2959								
73	12/26/2003	11206	7776	6.9	4	1	3	2959	6.57	6.57	5.62	5.4				14.8
74	12/27/2003			4.7	13.8	7.8	6	2959	6.42	6.42		4.8	22.6			
75	12/28/2003			5.9	7.8	1.75	6.05	2959	6.54	6.54	5.78	4.8	22.5			
76	12/29/2003	11549	8030	0.3	1.75	0.5	1.25	2959	6.62	6.62	5.12	5.7	22.4	170	15	14.2
77	12/30/2003			4.6	4.6	0	4.6	2959	6.12	6.12	5.03	6.3	22.5			
78	12/31/2003	11374	7924	4.0	4.6	0	4.6		6.38	6.67	5.32	5.9	22.6			15.2
79	01/01/2004				9.2		9.2									
80	01/02/2004	11875	8180	7.3		1	-1		6.50	6.67	5.21	5.3	23.3			14.8
81	01/03/2004			5.2	13.8	7.5			6.65	6.90		5.2	23.1			
82	01/04/2004			5.2	7.5	2			6.80	7.15	6.50	6.0	23.4			
83	01/05/2004	11791	8195	1.5	2	0			6.94	7.40	5.83	5.7	22.9	200	17	13.3
84	01/06/2004			4.4	4.6	0			6.82	7.35		4.7	225.0			
85	01/07/2004	11227	7714	4.2	4.6	0			6.89	7.44	6.86	5.2	21.9			13.9
86	01/08/2004			4.5	4.6	0.5			7.16	7.40		6.5	22.5			
87	01/09/2004															

						Chambers Works #2 NPSBC
		pH controllers				
		INITIAL	FINAL	Bicarb		
DAY	DATE	Bicarb	Bicarb	con-sumed	Waste Vol	
		mL	mL	mL	mL	COMMENTS
62	12/15/2003	150	150	0		same -- SWITCHED NCH LOAD TO SAME AS RX 3 (NPB - 4.5 mL treated sample / 4.6L feed)
63	12/16/2003	150	150	0		turbid, no foam
64	12/17/2003	150	150	0		turbid, no foam
65	12/18/2003	150	150	0		SWITCHED FEED TO 50% 2959 (NOT adding NH4Cl to new tote) --
66	12/19/2003	150	150	0		SWITCHED FEED ENTIRELY TO 2959 --
67	12/20/2003	150	150	0		Very turbid. Rx pH too low, adj controller. Increased air. Increased feed rate
68	12/21/2003	150	150	0		Turbid, DO high, lowered air
69	12/22/2003	150	150	0		Turbid, thin crown foam
70	12/23/2003	150	150	0		Slite turbid, thin white foam
71	12/24/2003	150	150	0		turbid
72	12/25/2003	150	150	0		
73	12/26/2003	150	125	25		all rxs. Added 4 drops H3PO4; yellow dried scum on freeboard
74	12/27/2003	125	125	0		looks ok, turbid
75	12/28/2003	125	125	0		clarifier effluent is turbid
76	12/29/2003	125	110	15		same
77	12/30/2003	110	110	0		moderately turbid, thin foam
78	12/31/2003	110	110	0		murky yellow
79	01/01/2004					
80	01/02/2004		110			start 30% drum 2966-1. Murky brownish thin foam
81	01/03/2004		110			same
82	01/04/2004		100			clarifier very turbid
83	01/05/2004		100			start 100% drum 2966-1. Turbid supernate, similar to 3. Sludge settles well
84	01/06/2004		100			v. turbid, thin foam.
85	01/07/2004		100			turbid, yellow/grey supernate
86	01/08/2004		100			turbid, thin foam. Eff saved for toxicity testing
87	01/09/2004					**1/8 end of test. Rxs sacrificed for odor panel and cakes**

		Chambers Works #3 NPBC																
		FEED																
		(Neutralized, Preferred, Base case, DCC)																
DAY	**DATE**	**Feed DOC sol**	**COD tot**	**COD, sol**	**BOD, sol**	**NO2-N**	**NO3-N**	**NH3-N**	**TN, inst**	**TDS**	**SO4**	**PO4-P, Hach**	**Phos-phon-ate-P**	**EMPA-P**	**EMPA**	**MPA**	**MPA-P**	**Total P**
		mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/l**	**mg/L**	**mg/L**	**Calc**		**mg/L**	**mg/L**	**mg/L**
1	10/15/2003																	
2	10/16/2003	372							97									
3	10/17/2003	358		932	589				81			8.1						
4	10/18/2003																	
5	10/19/2003																	
6	10/20/2003	348	1313	1030					76			7.9						
7	10/21/2003	331							111	2820							0	
8	10/22/2003	333		1156	547				109			6.2	7.3	1.1	4.4		0	
9	10/23/2003	258							67									
10	10/24/2003	513		1144		<1	<.5	29.2	118		1639	4.3	16.5	10.1	40.3	7	2.12	
11	10/25/2003																	
12	10/26/2003																	
13	10/27/2003	303	1311	1306		<1	<.5		87		1533	5.0	11.3	6.3	25.3	<2.5		13.7
14	10/28/2003	203							59	2967								
15	10/29/2003	294		1328	485	<1	<.5		75		1606	2.7	20.6	15.4	61.8	7.66	2.47	
16	10/30/2003	399							88									
17	10/31/2003	395				3.72	<.5		75		1437	5.4	20.5	13.2	52.7	5.81	1.88	
18	11/01/2003																	
19	11/02/2003																	
20	11/03/2003	263	940	894		19.27	<.5		55		596	3.3	20.0	14.5	58.1	6.89	2.22	
21	11/04/2003	202							44	3553								
22	11/05/2003	244		809	217				49				20.0	20.0	80.0			
23	11/06/2003	253				11.76	<.5	15.57	48		613					6.85	2.21	
24	11/07/2003	237							44			3.5	18.0	12.3	49.1		2.20	
25	11/08/2003																	
26	11/09/2003																	
27	11/10/2003	230	804	676		<1	<.5		39		660	4.3	21.8	15.5	61.9	6	2.05	
28	11/11/2003	219							31	3553								
29	11/12/2003	240		630	487				30			3.4	18.3	15.0	59.8			
30	11/13/2003	189				<1	<.5	13	27		743					7		
31	11/14/2003	207		619					28			4.3	19.5	15.2	60.6			

DAY	DATE	Chambers Works #3 NPBC																			
		EFFLUENT																			
DAY	DATE	Eff 3 DOC	COD tot	Eff 3 COD, sol	Eff 3 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phosphonate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/L	mg/L	mg/L	Calc		mg/L	mg/L	mg/L
1	10/15/2003																				
2	10/16/2003	36					65														
3	10/17/2003	50		144	3		66	40	28		1.3	15.87	1733	1.02	1.00				<2.5		
4	10/18/2003																				
5	10/19/2003																				
6	10/20/2003	45	154	153			54	28	22		4.09	32.16	1580	2.61	3.48				<2.5	0	
7	10/21/2003	45					60			3333										0	
8	10/22/2003	68		96			83	54	40		1.4	48.62	1546	3.36	3.5	4.1	0.60	2.4	<2.5	0	
9	10/23/2003	82					77														
10	10/24/2003	69		124		1.62	79	52	39		<1	46.41	1523	3.14					<2.5	0	
11	10/25/2003																				
12	10/26/2003																				
13	10/27/2003	67	396	229		1.79	69	206	144		<1	54.7	1595	2.59		14.5	10.31	41.2	4.96	1.60	19.2
14	10/28/2003	72					73			3393											
15	10/29/2003	74		213	19		60	145	99		1.32	56.95	1529	2.65		14.2	9.57	38.3	6.14	1.98	
16	10/30/2003	102					64														
17	10/31/2003	120					77	130	91		<1	43.64	1548	3		11.4	6.90	27.6	4.64	1.50	
18	11/01/2003																				
19	11/02/2003																				
20	11/03/2003	95	196	203			59	74	57		7.74	40.66	1367	3.37		14.4	8.66	34.7	7.33	2.37	
21	11/04/2003	99					59			3440											
22	11/05/2003	78		225	21		46	114	79					3.7		14.8	7.90	31.6		3.20	
23	11/06/2003	80				2.62	38				<1	30.53	672	3.65					9.97	3.22	
24	11/07/2003	76					35	68	44					3.7		15.4	8.50	34.0		3.20	
25	11/08/2003																				
26	11/09/2003																				
27	11/10/2003	75	240	192			30	49	17		<1	19.77	675	3.31		15.1	2.52	10.1	28.72	9.27	
28	11/11/2003	75					23			3733											
29	11/12/2003	73		244	2		21	59	37					3.8		14.8	0.00	0.0		11.00	
30	11/13/2003	67				2.25	19				<1	17.43	710	3.76					33.39	10.78	
31	11/14/2003	68		249			18	74	42					3.8		15.5	0.70	2.8		11.00	

		Chambers Works #3 NPBC														
		UNIT PERFORMANCE			FEED VOL											
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR
		mg/L	mg/L	mL	L	L	L					mg/L		mL/L	mL/g	mg/L/hr
1	10/15/2003								7.62			6.6	22.9			
2	10/16/2003			4.0	4.6	0.5	4.1	2941	7.58	7.91	5.46	6.1	22.3			
3	10/17/2003	12212	7691	4.6	4.6	0	4.6	2941	7.11	7.77	5.65	5.3	22.6			37.8
4	10/18/2003			6.0	14.6	8.2	6.4	2941	6.74	7.42	5.91	1.0	21.1			
5	10/19/2003			5.5	8.2	3	5.2	2941	6.48	7.03	6.21	3.1	20.7			
6	10/20/2003	12570	7691	2.8	3	0	3	2941	6.37	6.88	6.02	5.1	20.6			37.7
7	10/21/2003			3.2	4.6	1.1	3.5	2941	6.49	6.90	5.94	4.3	20.7			
8	10/22/2003	12727	8209	4.6	4.6	0	4.6	2941	6.59	6.94	5.60	4.4	20.7			37.4
9	10/23/2003			4.6	4.6	0.2	4.4	2941	6.56	6.95		2.7	22.4			
10	10/24/2003	12622	8261	4.6	4.6	0.4	4.2	2941	6.56	6.88	5.55	4.1	23.5			58.9
11	10/25/2003			6.0	14.1	7.5	6.6	2941	6.44			4.6	23.5			
12	10/26/2003			5.0	7.5	2.75	4.75	2941	6.79	6.96	6.11	4.8	21.8			48.9
13	10/27/2003	11843	7790	1.4	2.75	1	1.75	2941	6.71	7.01	6.12	5.6	20.9			
14	10/28/2003			4.6	4.6	0	4.6	2941	6.60	6.95		5.7	22.6			
15	10/29/2003	9671	6305	4.5	4.6	0	4.6	2941	6.51	6.95	6.15	5.4	2.2			51.9
16	10/30/2003			4.5	4.6	0	4.6	2941	6.57	6.90	6.20	5.7	22.5			
17	10/31/2003	10821	7109	4.0	4.6	0	4.6	2941	6.55	6.77	6.20	4.6	23.0	190		33.9
18	11/01/2003			5.8	14	8.6	5.4	2941	6.51	6.67	6.20	4.0	22.0			
19	11/02/2003			5.0	8.6	3.5	5.1	2941	6.41	6.82	6.20	6.6	22.5			
20	11/03/2003	8618	5701	2.8	3.5	0	3.5	**2947-1a**	6.71	6.87	5.81	2.5	21.4			19
21	11/04/2003			4.3	4.6	0.2	4.4	**2947-1b**	6.61	6.69	5.52	7.1	21.5			
22	11/05/2003	8711	5957	4.9	4.6	0	4.6	2947-1b	6.57	6.74	5.55	6.9	21.8		0	19.9
23	11/06/2003			4.6	4.6	0	4.6	2947-1b	6.36	6.92	5.62	3.9	21.6			
24	11/07/2003	7854	5219	4.2	4.6	0	4.6	**2947-1c (60%)**	6.44	6.99		4.1	22.3	150		22.1
25	11/08/2003			5.4	13.8	8.6	5.2	2947-1c 60%	6.42	7.03	5.90	3.2	22.3			
26	11/09/2003			4.6	8.6	4	4.6	2947-1c 60%	6.44		5.80	4.2	23.8			
27	11/10/2003	9248	6006	3.8	4	0	4	**2947-1c**	6.45	6.96	5.76	4.7	23.3			13.2
28	11/11/2003			3.8	4.6	0.8	3.8	**2947-1d 50%**	6.47	6.91		5.5	23.4			
29	11/12/2003	8751	5810	4.2	4.6	0.2	4.4	2947	6.29	6.95	6.22	4.0	21.4	160	18	17.9
30	11/13/2003			4.2	4.6	0	4.6	2947	6.40	6.97	5.56	3.2	20.9			
31	11/14/2003	7446	4889	4.6	4.6	0	4.6	2947	6.23	6.80	6.52	4.9	22.3			13.8

DAY	DATE	pH controllers INITIAL Bicarb mL	FINAL Bicarb mL	Bicarb con-sumed mL	Waste Vol mL	Chambers Works #3 NPBC COMMENTS
1	10/15/2003					Started CW WW, see rx #1
2	10/16/2003	300	300	0		looks good, clarifier 40% SS, translucent super
3	10/17/2003	300	300	0		Turbid super, looks good
4	10/18/2003	300	300	0		Increased DO to 300, looks good
5	10/19/2003	300	300	0		Do good, looks good
6	10/20/2003	300	280	20		pH alarm, pH at 6. Pump not on. Rx looks good, some foam. Lowered DO to 300
7	10/21/2003	280	270	10		Some foam in aerator, slite murky super. Lowered DO to 200
8	10/22/2003	270	240	30		a little foam in aerator, looks good.
9	10/23/2003	240	225	15		same, turbid clarifier.
10	10/24/2003	225	210	15		1/2" scummy foam, turbid supernate, BEGAN FEEDING NCH (4.5mL NPB/4.6mL FEED)
11	10/25/2003	210	190	20		lowered feed rate to "8", 1" black, thick foam, turbid clarifier
12	10/26/2003	190	160	30		same, added 2 drops of 1/10 anti-foam
13	10/27/2003	160	150	10		turbid clarifier, 1" scummy foam in aerator
14	10/28/2003	150	140	10		same, added 2 drops of 1/10 anti-foam
15	10/29/2003	140	100	40		lots of scummy foam, turbid supernate
16	10/30/2003	100	100	0		1 1/2" scummy foam, 1/4" blaket of floating solids on supernate
17	10/31/2003	100	100	0		1-2" scummy foam, opaque supernate, added 1 drop 1/10 AF
18	11/01/2003	100	200			heavy foaming, murky clarifier
19	11/02/2003	200	180	20		scummy foam nearly overflowing, turbid clarifier, added 2 drops 1/10 AF
20	11/03/2003	180	160	20	100	foaming almost over Rx, Turbid supernate, added 3 drops 1/10 AF, **feed switched to 2947**
21	11/04/2003	160	155	5		Scum caked walls, floating solids in clarifier, turbid, 1" scummy foam in aerator
22	11/05/2003	155	150	5		turbid clarifier, lots of scummy foam, lowered air flow
23	11/06/2003	150	150	0		less foam, turbid supernate
24	11/07/2003	150	150	0	100	1" scummy foam, turbid clarifier
25	11/08/2003	150	150	0		1/2" medium brown foam, very turbid
26	11/09/2003	150	150	0		1/2 - 1" scummy foam, turbid
27	11/10/2003	150	140	10	100	evidence of foaming but no foam (scummy walls), clarifier turbid
28	11/11/2003	140	140	0		1/2" scummy foam, turbid supernate, decreased air from "100" to "80"
29	11/12/2003	140	140	0	100	no foam, turbid clarifier
30	11/13/2003	140	125	15		thin foam, very turbid
31	11/14/2003	125	125	0	100	no foam, very turbid

		Chambers Works #3 NPBC																
		FEED																
		(Neutralized, Preferred, Base case, DCC)																
DAY	DATE	Feed DOC sol	COD tot	COD, sol	BOD, sol	NO2-N	NO3-N	NH3-N	TN, inst	TDS	SO4	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/L	mg/L	Calc		mg/L	mg/L	mg/L
32	11/15/2003																	
33	11/16/2003																	
34	11/17/2003	174		584		<1	1.48		29		630	6.0	16.7	8.9	35.6	6	1.84	
35	11/18/2003	289							61	2153								
36	11/19/2003	286	1014	915	492			28	60			4.6	23.1	16.7	66.7		1.80	
37	11/20/2003	265				<1	10.03		55		773					6	1.82	
38	11/21/2003	286							57			4.5	16.9	10.6	42.4		1.80	
39	11/22/2003																	
40	11/23/2003																	
41	11/24/2003	292		953		3.52	7.08	27	58		920	3.0	19.4	14.4	57.7	6	1.97	
42	11/25/2003	293							56	2233								
43	11/26/2003	262	1093	839	492	7.68	1.36		48		892	3.0	17.6	12.7	50.9	6	1.92	
44	11/27/2003																	
45	11/28/2003																	
46	11/29/2003																	
47	11/30/2003																	
48	12/01/2003	276		929		7.01	<.5		51		988					8	2.52	
49	12/02/2003	264							43	2307								
50	12/03/2003	254	963	741	492				40			1.3	15.0	11.8	47.2		1.90	15.0
51	12/04/2003	157				<1	0.66	19			811					<2.5	0	
52	12/05/2003	197		640					22			5.6	19.2	13.6	54.3			
53	12/06/2003																	
54	12/07/2003																	
55	12/08/2003	172		596		<1	1.14		13		773	5.3	20.1	12.2	48.9	8	2.57	
56	12/09/2003	163							12	1740								
57	12/10/2003	145	566	473	133				11			6.3	18.8	9.9	39.6		2.60	19.4
58	12/11/2003	144				<1	<.5	22	25		622					7	2.19	
59	12/12/2003	163		492					24			6.0	19.1	10.9	43.4		2.20	
60	12/13/2003	163																
61	12/14/2003	163																

DAY	DATE	Eff 3 DOC	COD tot	Eff 3 COD, sol	Eff 3 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phosphonate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		Chambers Works #3 NPBC																			
		EFFLUENT																			
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/L	mg/L	mg/L	Calc		mg/L	mg/L	mg/L
32	11/15/2003																				
33	11/16/2003																				
34	11/17/2003	56		221			18	38	23		<1	17.73	714	3.83		16.7	2.58	10.3	31.87	10.29	
35	11/18/2003	64					20			4253											
36	11/19/2003	69	264	190	11	6.83	26	56	35					3.3		15.4	1.50	6.0		10.60	
37	11/20/2003	71					30				<1	18.66	849	3.27					32.9	10.62	
38	11/21/2003	93					35	64	48					3.3		14.9	1.00	4.0		10.60	
39	11/22/2003																				
40	11/23/2003																				
41	11/24/2003	101		254		17.93	36	65	53		3.86	4.28	989	1.13		13.4	3.22	12.9	28.04	9.05	
42	11/25/2003	100					35			2120											
43	11/26/2003	114	334	195	62		41	40	32		<1	5.41	960	1.28		14.3	4.88	19.5	25.2	8.14	
44	11/27/2003																				
45	11/28/2003																				
46	11/29/2003																				
47	11/30/2003																				
48	12/01/2003	117		288			43	57	33		<1	1.16	968	1.18			-8.68		23.22	7.50	
49	12/02/2003	112					43			2467											
50	12/03/2003	115	404	320	74		39	108	65					0.5		14.1	4.60	18.4		9.00	14.8
51	12/04/2003	118				19.59	41				<1	<.5	997	0.47					18.68	6.03	
52	12/05/2003	116		370			34	97	57					0.5		14.4	7.90	31.6		6.00	
53	12/06/2003																				
54	12/07/2003																				
55	12/08/2003	74		192			11	58	35		<1	<.5	727	1.95		14.8	3.97	15.9	27.5	8.88	
56	12/09/2003	70					9			1760											
57	12/10/2003	64	228	174	9		4							2.9		16.1	2.90	11.6		10.30	16.6
58	12/11/2003	65				7.15	3				<1	<.5	658	2.91					31.88	10.29	
59	12/12/2003	63		158			5							2.9		19.5	6.30	25.2		10.30	
60	12/13/2003	64					10														
61	12/14/2003	57					12														

		Chambers Works #3 NPBC														
		UNIT PERFORMANCE			FEED VOL											
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR
		mg/L	mg/L	mL	L	L	L					mg/L		mL/L	mL/g	mg/L/hr
32	11/15/2003			4.0	13.8	10	3.8	2947	6.46	6.95	5.92	2.6	22.0			
33	11/16/2003			5.9	10	3.8	6.2	2947	6.20	6.94	5.92	2.1	21.9			
34	11/17/2003	9656	6416	3.4	3.8	0	3.8	2947	6.45	7.15	6.53	3.4	21.3			16.4
35	11/18/2003			4.5	4.6	0	4.6	**2951**	6.43	7.06	5.40	0.7	21.6			
36	11/19/2003	7815	5207	4.4	4.6	0	4.6	2951	6.54	7.09	5.40	1.2	21.3	160	20	17.1
37	11/20/2003			4.0	4.6	0	4.6	2951	6.60	6.96	5.64	4.4	21.0			
38	11/21/2003	6603	4382	4.6	4.6	0	4.6	2951	6.81	6.86	5.64	4.9	22.2			16.6
39	11/22/2003			4.7	13.8	9.5	4.6	2951								
40	11/23/2003			4.1	9.5	5	4.3	2951	6.53			3.2	23.2			
41	11/24/2003	5225	3554	4.6	5	0	4.5	2951	7.05	7.19	5.60	5.1	23.6			15.5
42	11/25/2003			4.6	4.6	0	5	2951	6.73	7.16	5.85	4.7	22.8			
43	11/26/2003	5681	3870	4.3	4.6	0	4.6	2951	6.63	7.07	5.86	4.8	21.5	140		14.7
44	11/27/2003				18.4		4.6	2951								
45	11/28/2003						18.4	2951								
46	11/29/2003			4.0		4	0	2951	7.14		6.50	5.6	22.2			
47	11/30/2003			4.0	4	0	-4	2951	7.18			5.9	21.7			
48	12/01/2003	7194	4904	4.4	4.6	0	4	2951	6.58	7.19	5.69	5.7	21.3			15.8
49	12/02/2003			4.2	4.6	0	4.6	2951-5	6.73	7.04	5.88	5.7	20.9			
50	12/03/2003	6557	4345	4.2	4.6	0	4.6	2951-5	6.49	6.94	6.27	5.2	22.7	150		14.1
51	12/04/2003			4.5	4.6	0	4.6	**37% 2954**	6.56	6.87		6.3	21.7			
52	12/05/2003	6520	4403	4.0	4.6	0	4.6	**100% 2954**	6.61	6.84	5.44	5.2	21.4		0	25.2
53	12/06/2003			5.0	13.8		13.8	2954	6.48							
54	12/07/2003			4.6		3.8	-3.8	2954	6.56	6.87	5.77	4.5	22.2			
55	12/08/2003	8587	5814	3.5	3.8	0	3.8	2954	6.54	6.99		5.6	21.7			11.7
56	12/09/2003			4.2	4.6	0.1	4.5	2954	6.46	6.87	5.72	4.9	21.4			
57	12/10/2003	7100	4791	4.2	4.6	0	4.6	2954	6.50	6.89	5.40	4.8	21.5		0	8.6
58	12/11/2003			4.3	4.6	0	4.6	2954	6.40	6.84	6.09	4.2	21.6			
59	12/12/2003	6952	4744	4.5	4.6	0.2	4.4	2954	6.45	6.92	6.11	5.0	21.6			5.7
60	12/13/2003			4.0	13.8	10	3.8	2954	6.42			4.9	21.5			
61	12/14/2003			5.6	10	3.9	6.1	2954	6.41			2.5	22.1			

						Chambers Works #3 NPBC
		pH controllers				
		INITIAL	FINAL	Bicarb		
DAY	DATE	Bicarb	Bicarb	con-sumed	Waste Vol	
		mL	mL	mL	mL	COMMENTS
32	11/15/2003	125	120	5		asame
33	11/16/2003	120	110	10		same, corrected pH setting
34	11/17/2003	110	100	10	50	same
35	11/18/2003	100	100	0		same -- Switched feed to 2951
36	11/19/2003	100	100	0	50	slightly turbid, no foam
37	11/20/2003	100	100	0		very turbid supernate, no foam, floating scum layer in clarifier
38	11/21/2003	100	90	10	50	same bicarb tubing eaten by pump again
39	11/22/2003	90	90	0		supernate almost clear, no foam
40	11/23/2003	90	75	15		same
41	11/24/2003	75	75	0		same
42	11/25/2003	250	250	0		very slightly turbid, no foam
43	11/26/2003	250	250	0		same
44	11/27/2003	250	250	0		
45	11/28/2003	250	250	0		
46	11/29/2003	250	250	0		some white foam, fairly clear supernate, settles fast, slight odor
47	11/30/2003	250	250	0		slightly turbid, no foam
48	12/01/2003	250	250	0		same
49	12/02/2003	250	250	0		turbid, no foam -- BEGAN FEEDING DRUM 5 FROM 2951
50	12/03/2003	250	250	0		same
51	12/04/2003	250	250	0		SWITCHED FEED TO 37% 2954 -- same
52	12/05/2003	250	250	0		SWITCHED FEED ENTIRELY TO 2954 -- same
53	12/06/2003	250	250	0		same
54	12/07/2003	250	250	0		same, decreased air "50"to"35"
55	12/08/2003	250	250	0		same
56	12/09/2003	250	250	0		slightly turbid, no foam
57	12/10/2003	250	250	0		slightly turbid, no foam
58	12/11/2003	250	250	0		same, decreased air "35" to "28" -- BEGAN ADDING 10 mg/L NH4Cl-N TO FEED FOR ALL REACTORS
59	12/12/2003	250	250	0		slightly turbid, no foam
60	12/13/2003	250	250	0		slightly more turbid, no foam
61	12/14/2003	250	240	10		slightly turbid, no foam

		Chambers Works #3 NPBC																
		FEED																
		(Neutralized, Preferred, Base case, DCC)																
DAY	DATE	Feed DOC sol	COD tot	COD, sol	BOD, sol	NO2-N	NO3-N	NH3-N	TN, inst	TDS	SO4	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/L	mg/L	Calc		mg/L	mg/L	mg/L
62	12/15/2003	162		529		<1	<.5		25		629	6.5	19.2	10.3	41.2	7	2.37	
63	12/16/2003	150							26	1833								
64	12/17/2003	148	521	461	301				24			5.1	20.1	12.6	50.4		2	18.5
65	12/18/2003	140				<1	7.04	26	38		1318					3		
66	12/19/2003	226		754					60			0.6	11.9	11.4	45.4			
67	12/20/2003																	
68	12/21/2003																	
69	12/22/2003	212	890	759		<1	14.23		59		1945	0.7	10.4	9.7	38.8	<2.5	0	
70	12/23/2003	229							60	5220								
71	12/24/2003																	
72	12/25/2003																	
73	12/26/2003	229			440	<1	14.53				2004					3	0.86	
74	12/27/2003																	
75	12/28/2003																	
76	12/29/2003	217		763		<1	14.22		66		1934	0.7	12.6	11.9	47.6	<2.5	0	19.1
77	12/30/2003	207						30	52	5593								
78	12/31/2003	226	891	612	429				59			0.5	11.1	10.6	42.3			
79	01/01/2004																	
80	01/02/2004	228		595		<1	14.07		60		1912					<2.5	0	
81	01/03/2004																	
82	01/04/2004																	
83	01/05/2004	275		987		<1	<.5		59		2421	5.3	18.6	11.7	46.8	5	1.58	
84	01/06/2004	312							58	8160								
85	01/07/2004	300	1092	1007	508				59			2.5	15.9	13.5	53.8			
86	01/08/2004	300																
87	01/09/2004																	

		Chambers Works #3 NPBC																			
		EFFLUENT																			
DAY	DATE	Eff 3 DOC	COD tot	Eff 3 COD, sol	Eff 3 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phosphonate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/L	mg/L	mg/L	Calc		mg/L	mg/L	mg/L
62	12/15/2003	55		210			10				<1	<.5	655	3.16		15.6	1.85	7.4	32.79	10.59	
63	12/16/2003	60					15			1713											
64	12/17/2003	59	213	125	19		13	43	23							14.6	4.00	16.0		10.60	16.3
65	12/18/2003	65				14.27	13				<1	<.5	644	3.18					33.73	10.89	
66	12/19/2003	53		157			20	38	23							13	2.10	8.4		10.90	
67	12/20/2003																				
68	12/21/2003																				
69	12/22/2003	54	189	228			31	14	14		<1	<.5	1918	0.9		8.7	2.55	10.2	16.27	5.25	
70	12/23/2003	62					36														
71	12/24/2003																				
72	12/25/2003																				
73	12/26/2003	63		222	32		42	25	11		<1	<.5	2053	0.9		8.6	2.33	9.3	16.63	5.37	
74	12/27/2003																				
75	12/28/2003																				
76	12/29/2003	53		206			43	29	1		<1	3.26	2017	0.9		9	2.87	11.5	16.21	5.23	9.1
77	12/30/2003	57				26.04	48			5060											
78	12/31/2003	60	215	150	17		47	44	23							9.7	9.70	38.8			
79	01/01/2004																				
80	01/02/2004	60		128			47	24	12		2.3	10.9	1986	0.9		9.4	3.41	13.7	15.75	5.09	
81	01/03/2004	65					48														
82	01/04/2004	68					38														
83	01/05/2004	69		226			37	122	66		<1	4.14	2087	0.9		10.3	4.40	17.6	15.48	5.00	
84	01/06/2004	70					37			6520											
85	01/07/2004	79	342	249	25	26.05	42	90	36							13.1	8.10	32.4	15.48	5.00	
86	01/08/2004	71					39				1.24	<.5	2644	<1					30.44		
87	01/09/2004																				

		Chambers Works #3 NPBC														
		UNIT PERFORMANCE			FEED VOL											
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR
		mg/L	mg/L	mL	L	L	L					mg/L		mL/L	mL/g	mg/L/hr
62	12/15/2003	7373	5077	3.8	3.9	0	3.9	2954	6.43	6.90	5.70	2.5	22.0			8.9
63	12/16/2003			4.6	4.6	0	4.6	2954	6.51	6.95	5.48	3.0	21.9			
64	12/17/2003	7647	5374	4.3	4.6	0	4.6	2954	6.36	6.93	5.41	1.1	21.8			9.3
65	12/18/2003			4.4	4.6	0	4.6	**50% 2959**	6.47	7.00	5.95	1.1	20.8			
66	12/19/2003	7300	5134	3.2	4.6	0	4.6	**2959**	6.52	7.06	5.48	1.6	21.6			8.4
67	12/20/2003			4.6	13.8	9.2	4.6	2959	6.25			1.4	22.4			
68	12/21/2003			5.8	9.2	3.3	5.9	2959	6.46			1.8	22.2			
69	12/22/2003	7748	5297	3.0	3.3	0	3.3	2959	6.67	7.00	5.42	2.5	21.4			12.5
70	12/23/2003			4.0	4.6	0.6	4	2959	6.62	7.07	5.53	1.0	22.0			
71	12/24/2003			6.4	13.8	7.8	6	2959	6.50							
72	12/25/2003				7.8	4	3.8	2959								
73	12/26/2003	8406	5677	7.1	4	0	4	2959	6.66	6.88	5.58	1.3	22.7			16.6
74	12/27/2003			4.6	13.8	8.2	5.6	2959	6.57	7.20		0.5	22.8			
75	12/28/2003			5.9	8.2	2	6.2	2959	6.66	6.94	5.81	4.2	22.7			
76	12/29/2003	9336	6229	1.5	2	0.3	1.7	2959	6.73	6.95	5.10	5.2	22.6	210	22	15.4
77	12/30/2003			4.5	4.6	0	4.6	2959	6.36	6.90	5.01	4.9	22.4			
78	12/31/2003	8902	5936	4.1	4.6	0		2959	6.38	6.72	5.24	6.3	22.6			13.7
79	01/01/2004				9.2											
80	01/02/2004	8727	5724	8.8		0			6.50	6.61	5.12	6.5	22.7			11
81	01/03/2004			5.2	13.8	7			6.72	6.85		6.0	22.6			
82	01/04/2004			5.1	7	2			6.82	6.63	6.45	6.0	22.8			
83	01/05/2004	9531	6250	1.4	2	0			6.97	7.20	5.81	6.3	22.3	280	29	13.7
84	01/06/2004			4.4	4.6	0			6.94	7.19		5.3	22.3			
85	01/07/2004	10464	6756	4.4	4.6	0			6.83	7.44	6.85	6.1	22.0			16.9
86	01/08/2004			4.6	4.6	0			7.18	7.40		6.9	22.6			
87	01/09/2004															

						Chambers Works #3 NPBC
		pH controllers				
		INITIAL	FINAL	Bicarb		
DAY	DATE	Bicarb	Bicarb	con-sumed	Waste Vol	
		mL	mL	mL	mL	COMMENTS
62	12/15/2003	240	240	0		slightly turbid, thin white foam
63	12/16/2003	240	240	0		more turbid, no foam
64	12/17/2003	240	240	0		Turbid, no foam
65	12/18/2003	240	240	0		SWITCHED TO LIVE NCH (same loading as before on NCH basis = 3.14mL treated sample / 4.6L Feed) -- SWITCHED TO 50% 2959 (NOT adding NH4Cl to new tote)
66	12/19/2003	240	240	0		SWITCHED FEED ENTIRELY TO 2959 --
67	12/20/2003	240	240	0		Some tubidity, thin white scum, pH low, increawswed air
68	12/21/2003	240	230	10		No foam, sl turbid
69	12/22/2003	230	230	0		Med turbidity
70	12/23/2003	230	230	0		same
71	12/24/2003	230	210	20		Sl turbid
72	12/25/2003	210	210	0		
73	12/26/2003	210	210	0		
74	12/27/2003	210	210	0		Turbid, increased air
75	12/28/2003	210	200	10		Turbidity similar to unit 2. Does not appear to settle as well as others
76	12/29/2003	200	200	0		
77	12/30/2003	200	200	0		Sl turbidity, 50% settled solids. This white foam
78	12/31/2003	200	200	0		murky yellow, no foam
79	01/01/2004	200	200	0		
80	01/02/2004	200	200	0		start 30% drum 2966-1 70% ss sl. Turbid, no foam
81	01/03/2004	200	200	0		60% ss, turbid
82	01/04/2004	200	200	0		clarifier is very turbid
83	01/05/2004	200	200	0		start 100% drum 2966-1 Sludge not settled well. Turbid eff, supernate. Some foam in rx. Yellow/brown scum on walls
84	01/06/2004	200	200	0		murky supernate, thin foam
85	01/07/2004	200	200			very turbid. Difficult to see settled sludge surface. Some foaming. Lowered air
86	01/08/2004	200	200			murky, thin foam. Eff saved for toxicity testing
87	01/09/2004					**1/8 end of test. Rxs sacrificed for odor panel and cakes**

		Chambers Works #4 NPLC																
		FEED																
		(Neutralized, Preferred, sLow acclimation, DCC)																
DAY	**DATE**	**Feed DOC sol**	**COD tot**	**COD, sol**	**BOD, sol**	**NO2-N**	**NO3-N**	**NH3-N**	**TN, inst**	**TDS**	**SO4**	**PO4-P, Hach**	**Phos-phon-ate-P**	**EMPA-P**	**EMPA**	**MPA**	**MPA-P**	**Total P**
		mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/l**	**mg/L**	**mg/L**	**Calc**		**mg/L**	**mg/L**	**mg/L**
1	10/15/2003																	
2	10/16/2003	372							97									
3	10/17/2003	358		932	589				81			8.1						
4	10/18/2003																	
5	10/19/2003																	
6	10/20/2003	348	1313	1030					76			7.9						
7	10/21/2003	331							111	2880							0	
8	10/22/2003	333		1156	547				109			6.2	7.3	1.1	4.4		0	
9	10/23/2003	258							67									
10	10/24/2003	503		1112		<1	<.5	23.8	120		1563	9.1	4.7	-4.4	-17.7	<2.5	0	
11	10/25/2003																	
12	10/26/2003																	
13	10/27/2003	297	1310	1118		<1	<.5		88		1482	5.4	9.8	4.5	17.8	<2.5	0	13.6
14	10/28/2003	220							67	2993								
15	10/29/2003	190		1144	497	<1	<.5		61		1552	3.9	8.3	4.4	17.7	<2.5	0.0	
16	10/30/2003	401							88									
17	10/31/2003	399				3.76	<.5		77		1401	6.4	11.5	5.1	20.5	<2.5	0.0	
18	11/01/2003																	
19	11/02/2003																	
20	11/03/2003	215	976	616		17.8	<.5		51		649	3.1	8.8	5.7	22.8	<2.5	0.0	
21	11/04/2003	209							46	3740								
22	11/05/2003	222		739	204				47				11.3	11.3	45.2			
23	11/06/2003	209				12.01	<.5	13.47	41		562					<2.5	0.0	
24	11/07/2003	204							39			4.0	11.2	7.2	28.8			
25	11/08/2003																	
26	11/09/2003																	
27	11/10/2003	186	684	654		<1	<.5		34		617	4.6	11.2	6.6	26.6	<2.5	0.0	
28	11/11/2003	178							26	3380								
29	11/12/2003	203		519	437				25			3.9	9.4	5.5	22.0		0.0	
30	11/13/2003	162				<1	<.5	12	25		708					4	1.3	
31	11/14/2003	179		551					46			2.5	10.4	6.6	26.4		1.3	

		Chambers Works #4 NPLC																			
		EFFLUENT																			
DAY	DATE	Eff 2 DOC	COD tot	Eff 4 COD, sol	Eff 4 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
1	10/15/2003																				
2	10/16/2003	35					68														
3	10/17/2003	60		140	0		76	47	30		<1	26.2	1752	1.19	1.18				<2.5		
4	10/18/2003																				
5	10/19/2003																				
6	10/20/2003	39	171	79			57	95	61		<1	56.3	1641	4.37	5.72				<2.5		
7	10/21/2003	44					66			3413										0	
8	10/22/2003	58		84			85	38	28		<1	40.0	1546	2.77	3.3	3.8	0.5	2.0	<2.5	0	
9	10/23/2003	69					75														
10	10/24/2003	61		**238**		5.8	80	62	43		<1	38.8	1546	2.79					<2.5	0	
11	10/25/2003																				
12	10/26/2003																				
13	10/27/2003							95	71		1	47.2	1537	2.66		7	7	28.0	<2.5	0	20.7
14	10/28/2003	43					64			2967											
15	10/29/2003	44		214	4		59	118	71		<1	62.3	1480	2.73	2.94	6.9	3.96	15.8	<2.5	0	
16	10/30/2003	61					59														
17	10/31/2003	105					88	53	41		<1	54.2	1531	2.93		5.5	1.53	6.1	3.2	1.0	
18	11/01/2003																				
19	11/02/2003																				
20	11/03/2003	50	144	89			45	45	37		<1	38.4	1364	2.64		6.6	2.82	11.3	3.5	1.1	
21	11/04/2003	54					53			3560											
22	11/05/2003	45		160	6		45	68	49							6.7	5.37	21.5		1.3	
23	11/06/2003	46				1.02	40				<1	35.2	670	3.38					4.1	1.3	
24	11/07/2003	44					35	44	31					3.4		7.2	2.47	9.9		1.3	
25	11/08/2003																				
26	11/09/2003																				
27	11/10/2003	46	358	211			25	43	16		4.43	13.0	625	2.84		7.3	2.60	10.4	5.8	1.9	
28	11/11/2003	46					15			3513											
29	11/12/2003	53		168	1		13	27	18					2.1		6.2	1.30	5.2		2.8	
30	11/13/2003	46				0	12				<1	14.8	663	2.06					8.8	2.8	
31	11/14/2003	41		238			11	40	20					2.1		7.9	3.00	12.0		2.8	

		Chambers Works #4 NPLC														
		UNIT PERFORMANCE			FEED VOL											
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR
		mg/L	mg/L	L	L	L	L					mg/L		mL/L	mL/g	mg/L/hr
1	10/15/2003								7.54			5.9	22.9			
2	10/16/2003			3.8	4.6	0.8	3.8	2941	7.00	7.80	5.46	2.1	22.4			
3	10/17/2003	15936	10038	4.5	4.6	0	4.6	2941	7.07	7.76	5.65	0.8	22.7			42.2
4	10/18/2003			5.8	14.6	9.2	5.4	2941	6.67	7.63	5.93	1.9	21.5			
5	10/19/2003			5.2	9.2	4	5.2	2941	6.46	7.39	6.57	4.4	20.7			
6	10/20/2003	9772	5821	0.0	4	3.5	0.5	2941	6.41		6.03	2.2	20.8			41.8
7	10/21/2003			3.9	4.6	0.5	4.1	2941	6.58	7.10	5.94	1.4	20.7			
8	10/22/2003	13456	8452	4.3	4.6	0.2	4.4	2941	6.51	7.20	5.60	2.5	20.6			41.4
9	10/23/2003			4.4	4.6	0.5	4.1	2941	6.57	7.06		1.6	22.7			
10	10/24/2003	13909	8367	4.3	4.6	0.4	4.2	2941	6.71	7.00	5.63	1.9	22.6			65.4
11	10/25/2003			5.6	14.2	8.2	6	2941	6.54			1.0	23.4			
12	10/26/2003			4.6	8.2	3.5	4.7	2941	6.62	7.18	6.10	1.0	21.8			67.1
13	10/27/2003	14877	9018	3.4	3.5	0.5	3	2941	6.52	7.06	6.09	4.0	20.9			
14	10/28/2003			4.5	4.6	0.2	4.4	2941	6.50	7.05		4.4	22.6			
15	10/29/2003	13575	8808	4.2	4.6	0.5	4.1	2941	6.59	7.04	6.10	2.1	22.1			57.8
16	10/30/2003			4.4	4.6	0	4.6	2941	6.56	7.00	6.12	2.8	22.2			
17	10/31/2003	13460	7100	4.0	4.6	0.8	3.8	2941	6.63	7.12	6.12	4.0	22.9	210		42.1
18	11/01/2003			5.2	13.8	8.7	5.1	2941	6.52	6.94	6.12	1.3	22.0			
19	11/02/2003			4.7	8.7	3.8	4.9	2941	6.54	7.05	6.12	4.4	21.5			
20	11/03/2003	11482	6712	1.2	3.8	2.5	1.3	**2947-1a**	6.59	7.26	5.97	5.4	21.3			34.1
21	11/04/2003			4.0	4.6	0.5	4.1	**2947-1b**	6.53	7.00	5.45	1.6	20.3			
22	11/05/2003	11866	7991	4.3	4.6	0.7	3.9	2947-1b	6.52	6.93	5.59	4.9	21.6			29
23	11/06/2003			4.4	4.6	0.5	4.1	2947-1b	6.60	6.84	5.64	5.0	21.5			
24	11/07/2003	8942	5880	4.6	4.6	0.2	4.4	**2947-1c (60%)**	6.54	6.89		6.2	22.2	210	23	25.1
25	11/08/2003			5.4	13.8	8.5	5.3	2947-1c 60%	6.48	6.88	5.95	4.2	22.1			
26	11/09/2003			4.1	8.5	4.5	4	2947-1c 60%	6.45			5.7	23.3			
27	11/10/2003	10625	6767	3.8	4.5	1	3.5	**2947-1c**	6.52	7.07	5.79	2.5	23.3			14.2
28	11/11/2003			3.9	4.6	0.5	4.1	**2947-1d 50%**	6.48	7.21		1.5	22.8			
29	11/12/2003	12779	8444	4.1	4.6	0.2	4.4	2947	6.78	7.55	6.21	1.7	21.2	190	15	15.9
30	11/13/2003			3.8	4.6	0.8	3.8	2947	6.86	7.45	5.51	3.7	20.9			
31	11/14/2003	8579	5604	4.3	4.6	0.5	4.1	2947	6.66	7.46	6.17	2.5	22.3			12

						Chambers Works #4 NPLC
		pH controllers				
		INITIAL	FINAL	Bicarb		
DAY	DATE	Bicarb	Bicarb	con-sumed	Waste Vol	
		mL	mL	mL	mL	COMMENTS
1	10/15/2003					Started feed CWWW
2	10/16/2003	250	250	0		looks good
3	10/17/2003	250	250	0		Same, increased air
4	10/18/2003	250	250	0		looks good
5	10/19/2003	250	250	0		A little scummy foam, otherwise looks good. Lowered DO to 450
6	10/20/2003	250	240	10		Not feeding, pH alarm. Grabbed clarifier for analytical
7	10/21/2003	240	230	10		Some foam, murky super. Small amt floating solids.
8	10/22/2003	230	220	10		1/2" foam, clarifier a little murky
9	10/23/2003	220	220	0		1/2" foam, turbid supernate, bicarb pump ate tubing, fixed.
10	10/24/2003	220	200	20		1" scummy foam, some floating chunks of solids in clarifier, BEGAN FEEDING NCH (1.1mL NPL/4.6mL FEED)
11	10/25/2003	200	200	0		lowered feed rate to "8", some black foam
12	10/26/2003	200	200	0		7/4" dark foam, added 1 drop 1/10 antifoam
13	10/27/2003	200	170	30		turbid clarifier, 1/2" scummy foam in aerator
14	10/28/2003	170	150	20		turbid clarifier, 1" scummy foam, added 2 drops 1/10 antifoam
15	10/29/2003	150	150	0		floating sludge chunks on super, 1" mostly white foam, black scum on edges of aerator
16	10/30/2003	150	125	25	250	1 1/2" scummy foam, 3 small floating sludge chunks on super, slightly cloudy supernate
17	10/31/2003	125	100	25		1" scummy foam, several sludge chunks on super, turbid supernate, added 1 drop 1/10 AF
18	11/01/2003	100	200			lots of foaming, some floating solids in clarifier
19	11/02/2003	200	200	0		2" scummy foam, small chunks of floating solids in clarifier, turbid. 1 drop 1/10 AF
20	11/03/2003	200	200	0	100	lowered air flowto "200", black, thick foam ~2", slightly turbid supernate **feed switched 2947**
21	11/04/2003	200	180	20		medium turbidity of supernate, scum caked walls, very foamy. Added 1 drop 1/10 AF
22	11/05/2003	180	180	0		very turbid clarifier, scummy foam to top of Rx, added 2 drops 1/10 AF
23	11/06/2003	180	180	0		same
24	11/07/2003	180	170	10	100	clarifier clearing, still turbid, scummy foam almost to top of Rx
25	11/08/2003	170	170	0		same, added 3 drops 1/10 AF
26	11/09/2003	170	160	10		scummy foam to top of Rx, added 2 drops 1/10, lowered air flow
27	11/10/2003	160	160	0	100	no foam, clarifier clearing, less turbid
28	11/11/2003	160	160	0		same, clear supernate, looks good. Increased air from "125" to "200"
29	11/12/2003	160	150	10		no foam, clear supernate, raised air from "175" to "250" -- Increased NCH load from0.0125% to 0.025% (from 1.1 to 2.2 mL/4.6L)
30	11/13/2003	150	150	0		supernate slightly turbid, 1" scummy foam, decreased air slightly
31	11/14/2003	150	140	10		clear supernate, no foam

		Chambers Works #4 NPLC																
		FEED																
		(Neutralized, Preferred, sLow acclimation, DCC)																
DAY	**DATE**	**Feed DOC sol**	**COD tot**	**COD, sol**	**BOD, sol**	**NO2-N**	**NO3-N**	**NH3-N**	**TN, inst**	**TDS**	**SO4**	**PO4-P, Hach**	**Phos-phon-ate-P**	**EMPA-P**	**EMPA**	**MPA**	**MPA-P**	**Total P**
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/L	mg/L	Calc		mg/L	mg/L	mg/L
32	11/15/2003																	
33	11/16/2003																	
34	11/17/2003	155		579		<1	1.51		26		613	6.1	14.5	7.4	29.5	3	1.0	
35	11/18/2003	248							55	2127								
36	11/19/2003	252	1030	826	467			27	54			4.8	12.4	6.6	26.2		1.0	
37	11/20/2003	250				<1	9.65		54		750					3	1.0	
38	11/21/2003	259							53			5.0	10.4	5.4	21.6			
39	11/22/2003																	
40	11/23/2003																	
41	11/24/2003	268		867		3.53	7.09	26	54		885		12.2	11.2	44.8	3	1.0	
42	11/25/2003	276							55	2133								
43	11/26/2003	274	1027	876	526	7.75	<.5		51		895	3.8	16.1	10.7	42.8	5	1.6	
44	11/27/2003																	
45	11/28/2003																	
46	11/29/2003																	
47	11/30/2003																	
48	12/01/2003	261		953		7.62	<.5		51		950					3	1.1	
49	12/02/2003	234							39	2193								
50	12/03/2003	229	824	673	526				37			1.5	9.1	7.7	30.6			9.8
51	12/04/2003	154				<1	0.68	19			806		5.2	5.2	20.8	<2.5	0.0	
52	12/05/2003	141		505					12			4.5	10.3	5.9	23.4			
53	12/06/2003																	
54	12/07/2003																	
55	12/08/2003	149		512		<1	1.17		10		755	5.3	13.4	6.5	26.0	5	1.6	
56	12/09/2003	137							9	1547								
57	12/10/2003	132	515	463	117				10			6.7	13.2	4.9	19.5		1.6	13.5
58	12/11/2003	128				<1	<.5	21	23		596					4	1.4	
59	12/12/2003	138		449					23			5.3	13.9	7.2	28.7		1.4	
60	12/13/2003	138																
61	12/14/2003	138																

		Chambers Works #4 NPLC																			
		EFFLUENT																			
DAY	DATE	Eff 2 DOC	COD tot	Eff 4 COD, sol	Eff 4 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
32	11/15/2003																				
33	11/16/2003																				
34	11/17/2003	38		206			32	36	23		<1	34.4	674	2.16		7.6	0.80	3.2	14.4	4.6	
35	11/18/2003	47					24			4347											
36	11/19/2003	46	198	196	6	1.25	24	50	32					2.5		8.9	1.80	7.2		4.6	
37	11/20/2003	48					33				<1	27.7	810	2.5					15.7	5.1	
38	11/21/2003	55					31	56	40					2.5		8.5	1.00	4.0		5.0	
39	11/22/2003																				
40	11/23/2003																				
41	11/24/2003	72		203		8.74	33	164	119		<1	21.3	979	1.41		9.8	3.50	14.0	15.2	4.9	
42	11/25/2003	88					38			2133											
43	11/26/2003	116	395	229	80		47	79	67		1.75	8.2	936	1.7		9	3.73	14.9	11.1	3.6	
44	11/27/2003																				
45	11/28/2003																				
46	11/29/2003																				
47	11/30/2003																				
48	12/01/2003	106		292			33	79	62		1.71	0.58	994	1.67					10.8	3.5	
49	12/02/2003	96					31			2387											
50	12/03/2003	98	335	276	58		30	94	72					1.7		7.7	1.10	4.4		4.9	14.8
51	12/04/2003	99				18.55	31				<1	<.5	978	0.79		7.9	4.13	16.5	9.2	3.0	
52	12/05/2003	87		270			27	82	64					0.8		7.3					
53	12/06/2003																				
54	12/07/2003																				
55	12/08/2003	56		179			4	62	47		<1	<.5	679	1.41		7.8	2.34	9.4	12.5	4.0	
56	12/09/2003	53					2			1867											
57	12/10/2003	50	229	150	14		0							2.3		9.5	3.20	12.8		4.0	10.0
58	12/11/2003	54				6.75	1				<1	<.5	635	2.33					13.1	4.2	
59	12/12/2003	52		158			2							2.3		12	5.50	22.0		4.2	
60	12/13/2003	53					9														
61	12/14/2003	52					14														

		Chambers Works #4 NPLC														
		UNIT PERFORMANCE			FEED VOL											
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR
		mg/L	mg/L	L	L	L	L					mg/L		mL/L	mL/g	mg/L/hr
32	11/15/2003			3.8	13.8	10.2	3.6	2947	6.78	7.60	5.89	1.0	22.1			
33	11/16/2003			5.4	10.2	4.5	5.7	2947	6.67	7.46	6.06	0.9	21.8			
34	11/17/2003	10963	7136	3.3	4.5	0	4.5	2947	6.71	7.59	6.61	0.6	21.2			14.1
35	11/18/2003			4.2	4.6	0.5	4.1	**2951**	6.67	7.36	5.40	1.3	21.7			
36	11/19/2003	9639	6367	4.2	4.6	0	4.6	2951	6.78	7.48	5.44	1.3	21.2	200	21	13.5
37	11/20/2003			4.0	4.6	0.5	4.1	2951	6.84	7.35	5.91	3.0	20.6			
38	11/21/2003	9375	6303	4.2	4.6	0.2	4.4	2951	6.80	7.23	5.47	2.8	21.9			14.5
39	11/22/2003			4.1	13.8	10	3.8	2951								
40	11/23/2003			4.0	10	5.9	4.1	2951	6.67			2.1	23.0			
41	11/24/2003	8422	5746	4.2	5.9	0.5	5.4	2951	7.00	7.20	5.63	5.2	23.2			19
42	11/25/2003			4.0	4.6	0.5	4.1	2951	7.05	7.08	5.88	5.3	22.3			
43	11/26/2003	8914	6063	4.1	4.6	0	4.6	2951	6.91	6.97	5.71	5.0	21.8	210		15.6
44	11/27/2003				18.4		18.4	2951								
45	11/28/2003						0	2951								
46	11/29/2003			3.8		4.9	-4.9	2951	7.13			5.5	22.5			
47	11/30/2003			4.5	4.9	1	3.9	2951	7.02			5.6	22.1			
48	12/01/2003	10020	6926	4.3	4.6	0.5	4.1	2951	6.90	7.36	5.74	7.6	21.8			11.2
49	12/02/2003			4.0	4.6	0	4.6	2951-5	6.95	7.31	5.87	5.7	21.3			
50	12/03/2003	8460	5730	3.9	4.6	0.7	3.9	2951	6.78	7.18	6.38	5.6	23.4	165		12.2
51	12/04/2003			3.9	4.6	0.7	3.9	**37% 2954**	6.96	7.19		5.9	22.0			
52	12/05/2003	9199	6314	3.7	4.6	0.5	4.1	**100% 2954**	6.97	7.18	5.77	6.4	21.6		0	12.6
53	12/06/2003			4.2	13.8		13.8	2954	6.77							
54	12/07/2003			4.2		4.4	-4.4	2954	6.89	6.95	5.96	5.1	21.9			
55	12/08/2003	10238	6965	3.4	4.4	0.2	4.2	2954	6.85	7.37		4.9	21.5			11.4
56	12/09/2003			3.9	4.6	0.2	4.4	2954	6.65	7.20	5.77	4.1	21.3			
57	12/10/2003	9966	6819	4.0	4.6	0.5	4.1	2954	6.75	7.14	5.63	4.8	21.5		0	9.6
58	12/11/2003			3.2	4.6	0.5	4.1	2954	6.62	7.27	6.23	3.3	21.6			
59	12/12/2003	9865	6758	4.0	4.6	0.5	4.1	2954	6.71	7.20	6.09	5.0	21.3			10.4
60	12/13/2003			4.0	13.8	9.7	4.1	2954	6.69			4.8	21.4			
61	12/14/2003			5.2	9.7	4	5.7	2954	6.66			3.8	21.9			

						Chambers Works #4 NPLC
		pH controllers				
		INITIAL	FINAL	Bicarb		
DAY	DATE	Bicarb	Bicarb	con-sumed	Waste Vol	
		mL	mL	mL	mL	COMMENTS
32	11/15/2003	140	120	20		same, increased air from "125" to "150"
33	11/16/2003	120	100	20		raised air from "90" to "125", clear supernate, no foam
34	11/17/2003	100	100	0		slightly turbid supernate, no foam, increased air
35	11/18/2003	100	100	0		same -- Switched Feed to 2951
36	11/19/2003	100	100	0	50	slightly turbid, thin scum in aerator
37	11/20/2003	100	50	50		looks great, patchy thin scum in aerator
38	11/21/2003	250	250	0	50	same
39	11/22/2003	250	250	0		slightly turbid, no foam
40	11/23/2003	250	225	25		same
41	11/24/2003	225	225	0		same
42	11/25/2003	225	225	0		slightly turbid, no foam
43	11/26/2003	225	225	0		slightly turbid, 1/2" very scummy foam
44	11/27/2003	225	225	0		
45	11/28/2003	225	225	0		
46	11/29/2003	225	225	0		murky supernate, 1/2" scummy foam
47	11/30/2003	225	225	0		turbid, 1" scummy foam
48	12/01/2003	225	225	0		slightly turbid, 1" scummy foam
49	12/02/2003	225	220	5		slightly turbid, thin foam -- BEGAN FEEDING DRUM 5 FROM 2951
50	12/03/2003	220	220	0		turbid, 1" scummy foam
51	12/04/2003	220	220	0		SWITCHED FEED TO 37% 2954 -- less turbid, 1/2" white foam
52	12/05/2003	220	220	0		SWITCHED FEED ENTIRELY TO 2954 -- same
53	12/06/2003	220	220	0		same
54	12/07/2003	220	220	0		slightly turbid, no foam, decreased air "140" to "90"
55	12/08/2003	220	220	0		same
56	12/09/2003	220	220	0		slightly turbid, no foam
57	12/10/2003	220	220	0		slightly turbid, no foam - Rx spill, recovered ~4L added 250mL from Rx 1 and 750mL from effluent
58	12/11/2003	220	210	10		slightly turbid, no foam, Increased feed rate to "9" -- BEGAN ADDING 10 mg/L NH4Cl-N TO FEED FOR ALL REACTORS
59	12/12/2003	210	210	0		slightly turbid, no foam
60	12/13/2003	210	210	0		same
61	12/14/2003	210	210	0		same

		Chambers Works #4 NPLC																
		FEED																
		(Neutralized, Preferred, sLow acclimation, DCC)																
DAY	**DATE**	**Feed DOC sol**	**COD tot**	**COD, sol**	**BOD, sol**	**NO2-N**	**NO3-N**	**NH3-N**	**TN, inst**	**TDS**	**SO4**	**PO4-P, Hach**	**Phos-phon-ate-P**	**EMPA-P**	**EMPA**	**MPA**	**MPA-P**	**Total P**
		mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/l**	**mg/L**	**mg/L**	**Calc**		**mg/L**	**mg/L**	**mg/L**
62	12/15/2003	127		407		<1	<.5		20		618	6.7	14.0	5.9	23.4	5	1.5	
63	12/16/2003	145							25	1807								
64	12/17/2003	151	464	425	293				25			5.1	19.4	12.8	51.3		1.5	18.9
65	12/18/2003	176				<1	6.9	28	41		1339					8	2.5	
66	12/19/2003	219		770					59			0.9	13.9	13.0	51.8			
67	12/20/2003																	
68	12/21/2003																	
69	12/22/2003	260	837	861		<1	14.05		63		1951	0.3	20.7	18.5	74.1	6	1.8	
70	12/23/2003	274							66	5733								
71	12/24/2003																	
72	12/25/2003																	
73	12/26/2003	274			428	<1	14.29				2006					8	2.6	
74	12/27/2003																	
75	12/28/2003																	
76	12/29/2003	300		1006		<1	14.08		72		1982	1.1	31.9	27.2	108.8	11	3.6	33.2
77	12/30/2003	257						34	58	5487								
78	12/31/2003	302	1187	783	443				69			0.2	27.0	23.2	92.7		3.6	
79	01/01/2004																	
80	01/02/2004	302		742		<1	14.07		72		1978					8	2.5	
81	01/03/2004																	
82	01/04/2004																	
83	01/05/2004	373		1170		<1	<.5		67		2451	4.1	35.0	30.9	123.5		0	
84	01/06/2004	298							56	8367								
85	01/07/2004	371	1399	1212	516				65			2.2	37.0	34.8	139.2			
86	01/08/2004	371																
87	01/09/2004																	

		Chambers Works #4 NPLC																			
		EFFLUENT																			
DAY	DATE	Eff 2 DOC	COD tot	Eff 4 COD, sol	Eff 4 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
62	12/15/2003	44		160			9				<1	<.5	652	2.85		14	5.97	23.9	16.1	5.2	
63	12/16/2003	56					15			1647											
64	12/17/2003	58	209	131	18		14	58	41							13.2	8.00	32.0		5.2	14.9
65	12/18/2003	68				15.19	14				<1	<.5	641	2.79					27.6	8.9	
66	12/19/2003	70		197			23	51	36					2.8		18.2	15.40	61.6			
67	12/20/2003																				
68	12/21/2003																				
69	12/22/2003	74	204	247			32	52	32		<1	<.5	1906	0.9		10.4	5.09	20.4	13.7	4.4	
70	12/23/2003	92					36														
71	12/24/2003																				
72	12/25/2003																				
73	12/26/2003	113		339	59		44	38	25		<1	<.5	2042	0.9		16.4	9.54	38.2	18.5	6.0	
74	12/27/2003																				
75	12/28/2003																				
76	12/29/2003	103		391			45	55	31		<1	<.5	2050	0.9		19.3	12.68	50.7	17.7	5.7	19.1
77	12/30/2003	121				31.3	51			5707											
78	12/31/2003	142	398	329	51		46	24	16							26	26.00	104.0			
79	01/01/2004																				
80	01/02/2004	141		290			47	18	10		<1	2.02	2015	0.9		26	17.60	70.4	23.2	7.5	
81	01/03/2004	148					50														
82	01/04/2004	151					52														
83	01/05/2004	151		442			53	40	20		<1	0.65	2173			27	13.55	54.2	41.7	13.4	
84	01/06/2004	92					49			6787											
85	01/07/2004	122	357	356	28	31.6	49	58	26							23	9.55	38.2	41.7	13.4	
86	01/08/2004	100					43				<1	<.5	2753	<1					55.2		
87	01/09/2004																				

		Chambers Works #4 NPLC														
		UNIT PERFORMANCE			FEED VOL											
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR
		mg/L	mg/L	L	L	L	L					mg/L		mL/L	mL/g	mg/L/hr
62	12/15/2003	10036	6888	2.8	4	0.5	3.5	2954	6.68	7.12	5.78	5.2	21.7			9.2
63	12/16/2003			3.9	4.6	0.5	4.1	2954	6.78	7.19	5.47	3.8	21.8			
64	12/17/2003	10174	7133	3.5	4.6	0.7	3.9	2954	6.70	7.31	5.40	0.7	21.6	150		15.1
65	12/18/2003			3.6	4.6	0.7	3.9	**50% 2959**	6.67	7.31	5.77	0.9	20.6			
66	12/19/2003	10549	7428	2.6	4.6	0.8	3.8	**2959**	6.57	7.27	5.34	1.6	21.5			8.8
67	12/20/2003			4.5	13.8	9.2	4.6		6.50			0.9	22.5			
68	12/21/2003			5.6	9.2	3.3	5.9		6.50			0.7	22.1			
69	12/22/2003	9605	6688	1.3	3.3	2	1.3		6.40	7.01	5.26	2.5	21.4			17.5
70	12/23/2003			3.3	4.6	1	3.6		6.68	7.01	5.22	1.5	21.9			
71	12/24/2003			6.2	13.8	8	5.8		6.62							
72	12/25/2003				8		8									
73	12/26/2003	10521	7275	5.7		1.5	-1.5		6.59	6.84	5.47	1.6	22.7			19.1
74	12/27/2003			4.7	13.8	8	5.8		6.56	7.04		1.3	22.8			
75	12/28/2003			5.9	8	2	6		6.59	6.93	5.19	0.6	22.8			
76	12/29/2003	11212	7787	0.5	2	1.5	0.5		6.74	7.11	4.90	2.1	22.2	190	17	18.9
77	12/30/2003			4.2	4.6	0	4.6		6.39	7.01	4.79	1.0	22.2			
78	12/31/2003	11476	7924	3.7	4.6				6.57	6.88	5.15	5.0	22.6			17.8
79	01/01/2004															
80	01/02/2004	11256	7578	8.6		0			6.55	6.84	5.10	1.8	23.0			17.5
81	01/03/2004			5.2	13.8	7			6.79	7.21		0.0				
82	01/04/2004			5.1	7	2			6.95	6.80	6.73	3.5	23.2			
83	01/05/2004	11598	7187	1.5	2	0			7.01	7.37	5.88	3.8	22.4	200	17	19.9
84	01/06/2004			4.0	4.6	0.5			6.93	7.27		4.2	22.3			
85	01/07/2004	12215	7899	4.2	4.6	0			6.79	7.40	6.86	4.5	21.9			19
86	01/08/2004			4.0	4.6	0.7			7.33	7.40		6.5	22.4			
87	01/09/2004															

						Chambers Works #4 NPLC
		pH controllers				
		INITIAL	FINAL	Bicarb		
DAY	DATE	Bicarb	Bicarb	con-sumed	Waste Vol	
		mL	mL	mL	mL	COMMENTS
62	12/15/2003	210	210	0		ADDED ADDITIONAL NCH TO BRING UP TO BASE CASE -- same, lowered air "50" to "30"
63	12/16/2003	210	210	0		NCH MAINTAINED AT BASE CASE -- slightly turbid, no foam
64	12/17/2003	210	210	0		turbid,no foam inc air 30-35
65	12/18/2003	210	210	0		SWITCHED FEED TO 50% 2959 (NOT adding NH4Cl to new tote) -- bit less turbid, no foam. Inc air
66	12/19/2003	210	210	0		SWITCHED FEED ENTIRELY TO 2959 -- sl. Turbid, very yellow in color, no foam
67	12/20/2003	210	210	0		fiarly clear, yellow, inc air
68	12/21/2003	210	210	0		same, inc air
69	12/22/2003	210	200	10		murky, thin foam. Inc fd. To 1.5x base loading
70	12/23/2003	200	200	0		same
71	12/24/2003	200	200	0		sl. Turbid
72	12/25/2003	200	200	0		
73	12/26/2003	200	200	0		very clear inc air
74	12/27/2003	200	200	0		same, looks good
75	12/28/2003	200	190	10		40% ss in clarifier; effluent is less turbid than unit 2 or 3. Inc air flow to 90
76	12/29/2003	190	190	0		rx turbid, feed NCH inc to 2x base case
77	12/30/2003	190	190	0		sl. Turbid, thin foam
78	12/31/2003	190	190	0		sl.turbid, thin white foam
79	01/01/2004	190	190	0		
80	01/02/2004	190	190	0		start 30% drum 2966-1 Murky, thin white foam
81	01/03/2004	190	190	0		same
82	01/04/2004	190	190	0		clarifier is less turbid then unit 2 or 3
83	01/05/2004	190	190	0		start 100% drum 2966-1 Sl. Turbid, much less than 2 or 3. Settled well. Some foam, yellow crusty build up on walls
84	01/06/2004	190	190	0		sl. Turbid, thin brown foam
85	01/07/2004	190	190	0		not as turbid as 2 or 3. Some foam. Scummy sludge clings to surfaces.
86	01/08/2004	190	190	0		sl. Turbid, thin white foam. Still better than 2 or 3. Eff saved for toxicity testing
87	01/09/2004					**1/8 end of test. Rxs sacrificed for odor panel and cakes**

		Chambers Works #5 NABC																
		FEED																
		(Neutralized, Alternate, Base case, DCC)																
DAY	**DATE**	**Feed DOC sol**	**COD tot**	**COD, sol**	**BOD, sol**	**NO2-N**	**NO3-N**	**NH3-N**	**TN, inst**	**TDS**	**SO4**	**PO4-P, Hach**	**Phos-phon-ate-P**	**EMPA-P**	**EMPA**	**MPA**	**MPA-P**	**Total P**
		mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/l**	**mg/L**	**mg/L**	**Calc**		**mg/L**	**mg/L**	**mg/L**
1	10/15/2003																	
2	10/16/2003	372							97									
3	10/17/2003	358		932	589				81			8.1						
4	10/18/2003																	
5	10/19/2003																	
6	10/20/2003	348	1313	1030					76			7.9						
7	10/21/2003	331							111	2860							0	
8	10/22/2003	333		1156	547				109			6.2	7.3	1.1	4.4		0	
9	10/23/2003	258							67									
10	10/24/2003	516		1208		<1	<.5	27.7	119		1752	5.5	17.9	10.2	40.8	7	2.2378	
11	10/25/2003																	
12	10/26/2003																	
13	10/27/2003	317	1297	1123		<1	<.5		91		1619	5.2	15.8	9.2	36.8	4.31	1.3918	24.4
14	10/28/2003	237							69	2820								
15	10/29/2003	192		1200	531	<1	<.5		61		1618	4.7	13.6	7.8	31.4	3.34	1.0785	
16	10/30/2003	417							99									
17	10/31/2003	400				2.97	<.5		75		1551	6.4	20.8	12.5	49.8	6.14	1.9827	
18	11/01/2003																	
19	11/02/2003																	
20	11/03/2003	258	1184	635		18.21	<.5		54		753	4.7	21.1	14.3	57.2	6.63	2.1409	
21	11/04/2003	239							47	3833								
22	11/05/2003	251		809	222				48				19.1	17.0	67.8		2.14	
23	11/06/2003	248				11.64	<.5	14.43	47		740					6.64	2.1442	
24	11/07/2003	245							44			5.0	20.8	13.8	55.0		2.10	
25	11/08/2003																	
26	11/09/2003																	
27	11/10/2003	234	805	730		<1	<.5		41		777	5.2	21.9	14.6	58.3	7	2.1151	
28	11/11/2003	213							30	3940								
29	11/12/2003	225		639	458				28			4.2	18.3	11.8	47.3		2.3	
30	11/13/2003	193				<1	<.5	12	29		891					7	2.2604	
31	11/14/2003	205		605					50			2.4	16.2	11.5	46.0		2.3	

		Chambers Works #5 NABC																			
		EFFLUENT																			
DAY	DATE	Eff 5 DOC	COD tot	Eff 5 COD, sol	Eff 5 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phosphonate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
1	10/15/2003																				
2	10/16/2003	30					63														
3	10/17/2003	41		84	2		48	74	53		<1	2.66	1763.1	1.12	1.19				<2.5		
4	10/18/2003																				
5	10/19/2003																				
6	10/20/2003	40	115	105			52	15	13		1.14	15.17	1574.2	1.48	2.78				<2.5		
7	10/21/2003	40					64			3167										0	
8	10/22/2003	48		120			69	39	29		<1	3.04	1540.8	1.74	1.9	3	1.3	5.0	<2.5	0	
9	10/23/2003	70					71														
10	10/24/2003	64		184		9.7	81	72	48		2.11	34.45	1576.5	3.11					<2.5	0	
11	10/25/2003																				
12	10/26/2003																				
13	10/27/2003	66					86	99	71		<1	52.29	1711.6	1.66		13.6	9.8	39.1	6.7	2.2	17.7
14	10/28/2003	66					65			3320											
15	10/29/2003	72		208	16		72	156	113		1.5	58.79	1624.3	3.76	3.94	15.9	8.2	32.9	12.1	3.9	
16	10/30/2003	101					70														
17	10/31/2003	109					94	71	53		<1	46.84	1648.4	3.96		12.4	4.2	16.9	13.1	4.2	
18	11/01/2003																				
19	11/02/2003																				
20	11/03/2003	91	244	148			57	94	71		<1	21.82	1510.6	4.07		14.7	7.5	29.8	9.8	3.2	
21	11/04/2003	109					60			3887											
22	11/05/2003	90		328	29		51	104	72					3		15.1	12.1	48.4			
23	11/06/2003	94				14.41	46				1.52	20.33	810.63	3.2					14.4	4.6	
24	11/07/2003	96					42	85	59					3		18	10.4	41.6		4.6	
25	11/08/2003																				
26	11/09/2003																				
27	11/10/2003	92	278	216			33	44	16		<1	15.83	764.18	3.47		16.2	5.2	20.7	23.4	7.5	
28	11/11/2003	88					21			3953											
29	11/12/2003	83		296	13		18	43	25					3		14.9	0.5	2.0		11.4	
30	11/13/2003	74				1.62	16				<1	13.87	798.97	2.98					35.3	11.4	
31	11/14/2003	67		302			43	53	27					3		15.5	1.1	4.4		11.4	

		Chambers Works #5 NABC														
		UNIT PERFORMANCE			FEED VOL											
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR
		mg/L	mg/L	L	L	L	L					mg/L		mL/L	mL/g	mg/L/hr
1	10/15/2003								7.46			5.0	23.3			
2	10/16/2003			3.8	4.6	1	3.6	2941	7.33	7.89	5.46	1.6	22.8			
3	10/17/2003	11810	7394	4.5	4.6	0.2	4.4	2941	7.38	7.90	5.65	0.2	22.8			36.9
4	10/18/2003			5.9	14.6	9	5.6	2941	7.24	7.89	5.96	1.4	19.9			
5	10/19/2003			5.2	9	4	5	2941	7.09	7.78	6.18	1.5	20.5			
6	10/20/2003	12749	7707	3.0	4	0.5	3.5	2941	6.53	7.64	6.40	1.1	20.7			34.9
7	10/21/2003			4.2	4.6	0.2	4.4	2941	7.11	7.61	5.95	0.4	20.6			
8	10/22/2003	11669	7324	4.7	4.6	0.1	4.5	2941	7.20	7.85	5.60	1.0	20.4			32.9
9	10/23/2003			4.5	4.6	0	4.6	2941	6.53	7.59		1.6	22.1			
10	10/24/2003	12139	7795	4.2	4.6	0.6	4	2941	6.01	6.81	4.75	3.6	23.1			46.2
11	10/25/2003			6.0	14.1	8	6.1	2941	7.79			3.7	23.3			
12	10/26/2003			4.7	8	3.5	4.5	2941	7.12	8.02	5.16	4.0	21.6			46.3
13	10/27/2003	12588	8057	3.3	3.5	0	3.5	2941	6.83	7.35	5.54	4.3	20.8			
14	10/28/2003			4.7	4.6	0.2	4.4	2941	6.50	7.06		4.2	22.5			
15	10/29/2003	12630	8215	4.5	4.6	0	4.6	2941	6.20	6.67	5.53	4.7	22.1			47.2
16	10/30/2003			4.4	4.6	0.2	4.4	2941	6.20	6.44	5.49	5.3	22.2			
17	10/31/2003	12354	8117	4.0	4.6	0	4.6	2941	6.27	6.61	5.49	4.7	22.7	200		31.3
18	11/01/2003			5.2	13.8	9	4.8	2941	6.18	6.64	5.49	3.7	21.9			
19	11/02/2003			4.9	9	4	5	2941	6.16	6.30	5.49	6.2	21.5			
20	11/03/2003	8019	5312	1.4	4	2	2	**2947-1a**	6.16	6.49	5.22	7.3	21.2			18.7
21	11/04/2003			4.0	4.6	0	4.6	**2947-1b**	6.42	6.53	4.92	5.9	21.2			
22	11/05/2003	12922	8776	4.5	4.6	0.2	4.4	2947-1b	6.49	6.63	4.77	6.5	21.7		0	16.2
23	11/06/2003			4.2	4.6	0.8	3.8	2947-1b	6.40	6.55	4.92	6.5	21.5			
24	11/07/2003	8441	5574	4.6	4.6	0.8	3.8	**2947-1c (60%)**	6.28	6.52		5.5	22.4	180		18.6
25	11/08/2003			5.2	13.8	8.9	4.9	2947-1c 60%	6.32	6.64	5.50	6.0	22.3			
26	11/09/2003			4.1	8.9	4.5	4.4	2947-1c 60%	6.26			5.5	23.8			
27	11/10/2003	9691	6183	4.2	4.5	0.5	4	**2947-1c**	6.29	6.49	5.46	6.3	24.1			10.2
28	11/11/2003			4.2	4.6	0.2	4.4	**2947-1d 50%**	6.21	6.55		5.8	23.5			
29	11/12/2003	10722	7051	4.2	4.6	0.5	4.1	2947	6.38	7.09	6.06	2.4	21.2	175	16	13.5
30	11/13/2003			4.3	4.6	0	4.6	2947	6.47	7.11	5.03	2.6	20.8			
31	11/14/2003	7834	5150	4.4	4.6	0	4.6	2947	6.34	7.08	5.74	3.4	22.3			14.8

						Chambers Works #5 NABC
		pH controllers				
		INITIAL	**FINAL**	**Bicarb**		
DAY	**DATE**	**Bicarb**	**Bicarb**	**con-sumed**	**Waste Vol**	
		mL	**mL**	**mL**	**mL**	**COMMENTS**
1	10/15/2003	230	230	0		Start feeding CW WW
2	10/16/2003	230	230	0		Looks good
3	10/17/2003	230	230	0		Same, increased air
4	10/18/2003	230	230	0		Looks good
5	10/19/2003	230	230	0		Looks good
6	10/20/2003	230	230	0		Looks good, thin foam. Increased DO to 600
7	10/21/2003	230	230	0		Same, increased air to 700
8	10/22/2003	230	230	0		air increased to "950", looks good
9	10/23/2003	230	0	230		thin foam in aerator, Rx looks ok, turbid supernate
10	10/24/2003	250	230	20		pH too low, adj low control pH pump, fed all bicarb by 4:00 pm. Floating scum in clarifier, BEGAN FEEDING NCH (7.3mL AB/4.6mL FE
11	10/25/2003	230	225	5		lowered feed rate to "8", Issues with pH, bicarb pump in manual, so fed bicarb yesterday. Black foam
12	10/26/2003	225	225	0		Turbid supernate 1 1/2" dark scum an foam in aerator
13	10/27/2003	225	225	0		turbid clarifier, 1" scummy foam
14	10/28/2003	225	225	0		same
15	10/29/2003	225	210	15		scummy foam, lots of floating sludge on supernate
16	10/30/2003	210	210	0	250	1 1/2" scummy foam, 1/4" blanket of floating solids in clarifier, turbid supernate
17	10/31/2003	210	200	10		1 1/2" white foam in aerator, clarifier 70% full of solids, turbid effluent
18	11/01/2003	200	200	0		2" white foam with scum coating, turbid supernate, added 1 drop 1/10 AF
19	11/02/2003	200	200	0		increased low pH, lowered air flow to "500", ~2" foam, slightly turbid supernate, added AF
20	11/03/2003	200	200	0	100	**feed switched to 2947**
21	11/04/2003	200	200	0		1" scummy foam, turbid supernate
22	11/05/2003	200	200	0		turbid clarifier, lots of scummy foam
23	11/06/2003	200	200	0	100	1-2" scummy foam, turbid clarifier (less than yesterday), lowered air flow
24	11/07/2003	200	200	0	100	1" scummy foam, turbid supernate
25	11/08/2003	200	190	10		same, 2 drops 1/10 AF
26	11/09/2003	190	190	0		1-2" scummy foam, turbid, 1 drop 1/10 AF
27	11/10/2003	190	190	0	100	1-2" scummy foam, turbid clarifier, decreased air from "450" to "300"
28	11/11/2003	190	190	0		1 1/2" scummy foam, slightly turbid supernate, decreases air from "250" to "175"
29	11/12/2003	190	175	15	100	slightly turbid, no foam
30	11/13/2003	175	170	5		same
31	11/14/2003	170	150	20	100	same

		Chambers Works #5 NABC																
		FEED																
		(Neutralized, Alternate, Base case, DCC)																
DAY	**DATE**	**Feed DOC sol**	**COD tot**	**COD, sol**	**BOD, sol**	**NO2-N**	**NO3-N**	**NH3-N**	**TN, inst**	**TDS**	**SO4**	**PO4-P, Hach**	**Phos-phon-ate-P**	**EMPA-P**	**EMPA**	**MPA**	**MPA-P**	**Total P**
		mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/l**	**mg/L**	**mg/L**	**Calc**		**mg/L**	**mg/L**	**mg/L**
32	11/15/2003																	
33	11/16/2003																	
34	11/17/2003	175		660		<1	1.54		28		761	6.3	20.8	12.6	50.5	6	1.9375	
35	11/18/2003	283							60	2267								
36	11/19/2003	290	970	892	491			27	59			5.7	18.1	11.7	46.6		0.8	
37	11/20/2003	238				<1	9.59		52		787					3	0.8493	
38	11/21/2003	288							53			5.9	19.7	13.0	51.9		1	
39	11/22/2003																	
40	11/23/2003																	
41	11/24/2003	285		904		3.4	7.09	27	56		1030		20.5	18.5	74.2	6	1.9569	
42	11/25/2003	303							57	2393								
43	11/26/2003	276	1193	843	491	7.61	<.5		49		1016	5.3	20.9	13.6	54.5	6	1.973	
44	11/27/2003																	
45	11/28/2003																	
46	11/29/2003																	
47	11/30/2003																	
48	12/01/2003	266		863		6.99	<.5		50		1026					6	1.8729	
49	12/02/2003	256							41	2853								
50	12/03/2003	247	894	731	491				38			4.3	18.0	11.7	46.6		2	19.7
51	12/04/2003	149				<1	0.65	19			821					<2.5	0	
52	12/05/2003	180		614					17			7.3	19.5	12.2	48.9			
53	12/06/2003																	
54	12/07/2003																	
55	12/08/2003	175		582		<1	1.13		13		908	9.0	22.5	11.2	44.8	7	2.2927	
56	12/09/2003	171							13	1840								
57	12/10/2003	156	621	512	143				13			8.1	19.8	9.4	37.5		2	19.9
58	12/11/2003	158				<1	<.5	22	28		733					7	2.3153	
59	12/12/2003	164		517					25			5.8	20.1	12.0	48.2		2.3	
60	12/13/2003	164																
61	12/14/2003	164																

		Chambers Works #5 NABC																			
		EFFLUENT																			
DAY	DATE	Eff 5 DOC	COD tot	Eff 5 COD, sol	Eff 5 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phosphonate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
32	11/15/2003																				
33	11/16/2003																				
34	11/17/2003	67		207			43	46	28		<1	33.34	792.57	1.57		14.5	2.2	8.8	33.2	10.7	
35	11/18/2003	67					32			4247											
36	11/19/2003	69	238	216	11	1.89	29	59	36					2		14.1	1.4	5.6		10.7	
37	11/20/2003	75					33				<1	27.75	929.62	2.23					33.4	10.8	
38	11/21/2003	83					35	43	30					2		14.5	1.7	6.8		10.8	
39	11/22/2003																				
40	11/23/2003																				
41	11/24/2003	99		260		15.33	42	191	137		<1	14.57	1054.1	1.44		14.8	3.3	13.1	31.2	10.1	
42	11/25/2003	116					42			2360											
43	11/26/2003	147	476	273	77		52	84	70		4.05	3.81	1046.1	1.19		15.4	4.2	16.8	21.6	10.0	
44	11/27/2003																				
45	11/28/2003																				
46	11/29/2003																				
47	11/30/2003																				
48	12/01/2003	125		382			37	79	62		2.86	<.5	1076.7	1.02					23.9	7.7	
49	12/02/2003	118					34			2553											
50	12/03/2003	119	377	354	61		32	90	67					1		15.2	6.5	26.0		7.7	15.3
51	12/04/2003	123				20.37	34				<1	<.5	1085.2	0.54					21.0	6.8	
52	12/05/2003	112		317			29	79	58							13.4					
53	12/06/2003																				
54	12/07/2003																				
55	12/08/2003	83		232			8	80	58		<1	<.5	831.58	1.15		14.9	6.4	25.5	22.8	7.4	
56	12/09/2003	77					4			1867											
57	12/10/2003	78	309	219	25		0							1.9		15.8	6.5	26.0		7.4	16.3
58	12/11/2003	80				6.73	4				<1	<.5	759.4	1.89					17.9	5.8	
59	12/12/2003	79		210			5							1.9		18.1	10.4	41.6		5.8	
60	12/13/2003	80					11														
61	12/14/2003	80					17														

		Chambers Works #5 NABC														
		UNIT PERFORMANCE			FEED VOL											
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR
		mg/L	mg/L	L	L	L	L					mg/L		mL/L	mL/g	mg/L/hr
32	11/15/2003			3.9	13.8	10	3.8	2947	6.48	7.09	5.61	1.7	22.1			
33	11/16/2003			5.7	10	4.3	5.7	2947	6.38	6.98	5.81	1.0	21.8			
34	11/17/2003	9475	6273	3.4	41.3	0.5	40.8	2947	6.52	7.25	6.09	0.2	21.2			19.9
35	11/18/2003			4.6	4.6	0.2	4.4	**2951**	6.50	6.89	4.76	4.0	21.8			
36	11/19/2003	6935	4528	4.4	4.6	0.2	4.4	2951	6.52	6.97	5.67	3.9	21.5	160	23	20.3
37	11/20/2003			4.4	4.6	0	4.6	2951	6.54	6.93	6.50	5.1	20.1			
38	11/21/2003	8280	5535	4.6	4.6	0	4.6	2951	6.60	6.93	5.04	3.9	22.3			18.9
39	11/22/2003			4.6	13.8	9.5	4.3	2951								
40	11/23/2003			4.0	9.5	5.5	4	2951	6.51			3.2	23.1			
41	11/24/2003	6983	4738	4.6	5.5	0	5.5	2951	6.87	6.93	4.89	6.3	23.8			20.4
42	11/25/2003			4.4	4.6	0	4.6	2951	6.80	7.00	5.11	5.9	23.4			
43	11/26/2003	7364	4978	4.4	4.6	0	4.6	2951	6.62	6.91	5.22	6.1	22.1	140		12.7
44	11/27/2003				18.4		18.4	2951								
45	11/28/2003						0	2951								
46	11/29/2003			4.1		5	-5	2951		6.81		6.0	22.5			
47	11/30/2003			4.3	5	0	5	2951	6.91			6.1	22.2			
48	12/01/2003	7556	51958	4.6	4.6	0	4.6	2951	6.53	7.01	5.12	6.5	21.8			10.3
49	12/02/2003			4.2	4.6	0.1	4.5	2951-5	6.69	6.95	5.33	6.4	21.2			
50	12/03/2003	6289	4219	4.1	4.6	0.5	4.1	2951-5	6.61	6.83	5.44	6.4	23.4	140		9.4
51	12/04/2003			4.3	4.6	0	4.6	**37% 2954**	6.62	6.80		6.3	21.9			
52	12/05/2003	6462	4400	3.9	4.6	0.6	4	**100% 2954**	6.63	6.81	4.40	6.4	21.6		0	8.8
53	12/06/2003			4.8	13.8		13.8	2954	6.51							
54	12/07/2003			4.2		4.7	-4.7	2954	6.56	6.76	4.49	5.9	22.3			
55	12/08/2003	8541	5811	3.6	4.7	0.1	4.6	2954	6.41	6.89		5.1	21.9			9.6
56	12/09/2003			3.8	4.6	0.3	4.3	2954	6.41	6.65	4.54	5.9	21.8			
57	12/10/2003	7598	5206	3.2	4.6	1	3.6	2954	6.47	6.77	4.45	5.9	21.7		0	8.3
58	12/11/2003			4.0	4.6	0.7	3.9	2954	6.24	6.69	4.52	5.7	21.8			
59	12/12/2003	7883	5377	4.0	4.6	0.8	3.8	2954	6.56	6.73	4.91	7.2	21.6			6.3
60	12/13/2003			3.9	13.8	10.1	3.7	2954	6.47			6.1	21.4			
61	12/14/2003			5.5	10.1	4.6	5.5	2954	6.43			4.6	22.1			

						Chambers Works #5 NABC
		pH controllers				
		INITIAL	FINAL	Bicarb		
DAY	DATE	Bicarb	Bicarb	con-sumed	Waste Vol	
		mL	mL	mL	mL	COMMENTS
32	11/15/2003	150	150	0		same
33	11/16/2003	150	120	30		same, increased air from "100" to "125", corrected pH calibration (only slightly off)
34	11/17/2003	120	120	0	50	turbid supernate, no foam, increased air
35	11/18/2003	120	100	20		switched feed to 2951 -- 1/2" foam with little scum, turbid supernate
36	11/19/2003	100	100	0	50	1/2"-1" very scummy foam, turbid clarifier
37	11/20/2003	100	60	40		no foam, turbid supernate, lowered air to "300"
38	11/21/2003	250	250	0	50	thin scummy foa , clarifier a little clearer
39	11/22/2003	250	250	0		slightly turbid, no foam
40	11/23/2003	250	225	25		same
41	11/24/2003	225	225	0		slightly turbid, 1/4" foam
42	11/25/2003	225	225	0		slightly turbid, 1/2" scummy foam
43	11/26/2003	225	225	0		turbid, 1" scummy foam
44	11/27/2003	225	225	0		
45	11/28/2003	225	225	0		
46	11/29/2003	225	225	0		murky supernate, 1/2" foam
47	11/30/2003	225	225	0		turbid supernate, 1" scummy foam
48	12/01/2003	225	225	0		less turbid
49	12/02/2003	225	225	0		slightly turbid, thin white foam -- BEGAN FEEDING DRUM 5 FROM 2951
50	12/03/2003	225	220	5		turbid, 1/2" white foam, scum on walls, lowered air
51	12/04/2003	220	210	10		SWITCHED FEED TO 37% 2954 -- less turbid, thin white foam
52	12/05/2003	210	210	0		SWITCHED FEED ENTIRELY TO 2954 -- same
53	12/06/2003	210	210	0		same
54	12/07/2003	210	210	0		slightly turbid, thin white foam, lowered air "200" to "120"
55	12/08/2003	210	200	10		same
56	12/09/2003	200	200	0		turbid, thin white foam
57	12/10/2003	200	200	0		turbid, thin white foam
58	12/11/2003	200	200	0		same - increased feed rate to "9" - decreased air "70" to "50" -- BEGAN ADDING 10 mg/L NH4Cl-N TO FEED FOR ALL REACTORS
59	12/12/2003	200	200	0		feed problem, replaced tubing - turbid, no foam
60	12/13/2003	200	200	0		less turbid, thin white foam
61	12/14/2003	200	200	0		medium turbidity, thin white foam

Chambers Works #5 NABC

FEED

(Neutralized, Alternate, Base case, DCC)

DAY	DATE	Feed DOC sol	COD tot	COD, sol	BOD, sol	NO2-N	NO3-N	NH3-N	TN, inst	TDS	SO4	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/L	mg/L	Calc		mg/L	mg/L	mg/L
62	12/15/2003	168		455		<1	<.5		25		735	6.4	19.4	10.7	42.8	7	2.2798	
63	12/16/2003	160							26	1953								
64	12/17/2003	158	543	355	273				25			6.1	19.7	11.3	45.2		2	20.0
65	12/18/2003	193				<1	7.03	27	43		1452					5	1.7631	
66	12/19/2003	234		789					60			0.5	20.5	18.3	73.0		2	
67	12/20/2003																	
68	12/21/2003																	
69	12/22/2003	224	840	763		<1	14.08		60		2013	0.4	12.8	11.1	44.5	4	1.2658	
70	12/23/2003	252							64	5593								
71	12/24/2003																	
72	12/25/2003																	
73	12/26/2003	252			423	<1	14.26				2073					6	1.8342	
74	12/27/2003																	
75	12/28/2003																	
76	12/29/2003	241		802		<1	14.05		66		2008	1.6	17.5	14.1	56.6	5	1.7373	21.4
77	12/30/2003	211						31	51	5913								
78	12/31/2003	250	864	637	421				64			0.4	15.2	14.8	59.3			
79	01/01/2004																	
80	01/02/2004	257		629		<1	14.16		64		2028					6	1.8923	
81	01/03/2004																	
82	01/04/2004																	
83	01/05/2004	323		1090		<1	<.5		63		2503	6.5	24.0	15.4	61.6	7	2.1119	
84	01/06/2004	333							62	8380								
85	01/07/2004	330	1260	1043	492				63			2.4	19.9	17.6	70.2			
86	01/08/2004	330																
87	01/09/2004																	

		Chambers Works #5 NABC																			
		EFFLUENT																			
DAY	DATE	Eff 5 DOC	COD tot	Eff 5 COD, sol	Eff 5 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phosphonate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
62	12/15/2003	78		173			13				<1	<.5	820.25	2.23		18.1	9.6	38.5	19.4	6.3	
63	12/16/2003	75					15			1940											
64	12/17/2003	68	150	155	49		12	44	31							13.5	7.2	28.8		6.3	16.5
65	12/18/2003	72				14.78	13				<1	<.5	750.5	2.37					19.0	6.1	
66	12/19/2003	73					24	31	21							13.6	7.5	30.0		6.1	
67	12/20/2003																				
68	12/21/2003																				
69	12/22/2003	72	196	224			44	29	17		<1	9.43	2009	0.9		10.4	6.9	27.6	8.1	2.6	
70	12/23/2003	75					46														
71	12/24/2003																				
72	12/25/2003																				
73	12/26/2003	80		302	31		47	27	9		<1	<.5	2169.6	0.9		11.6	7.6	30.4	9.6	3.1	
74	12/27/2003																				
75	12/28/2003																				
76	12/29/2003	84		275			55	63	36		<1	<.5	2136.8	0.9		14.5	7.6	30.5	18.5	6.0	14.3
77	12/30/2003	92				33.19	58			5853											
78	12/31/2003	94	310	236	33		49	42	24							14.6	14.6	58.4			
79	01/01/2004																				
80	01/02/2004	92		224			48	33	14		5.88	<.5	2091.6	0.9		14.6	8.9	35.6	14.8	4.8	
81	01/03/2004	97					50														
82	01/04/2004	102					47														
83	01/05/2004	103		273			50	68	40		<1	<.5	2212.7	0.9		14.7	6.5	26.1	22.5	7.3	
84	01/06/2004	110					51			6993											
85	01/07/2004	121	401	378	45	31.14	49	58	24							23.9	16.6	66.5	22.5	7.3	
86	01/08/2004	112					45				<1	<.5	2778.1	<1					23.0		
87	01/09/2004																				

		Chambers Works #5 NABC														
		UNIT PERFORMANCE			FEED VOL											
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR
		mg/L	mg/L	L	L	L	L					mg/L		mL/L	mL/g	mg/L/hr
62	12/15/2003	7899	5440	2.6	4.6	1	3.6	2954	6.39	6.73	4.57	4.2	21.6			6.4
63	12/16/2003			4.4	4.6	0.25	4.35	2954	6.44	6.86	4.37	1.8	21.6			
64	12/17/2003	8850	6187	4.0	4.6	0.5	4.1	2954	6.46	6.94	4.20	2.5	21.5	150		8.4
65	12/18/2003			4.2	4.6	0.2	4.4	**50% 2959**	6.39	6.87	4.74	2.2	20.6			
66	12/19/2003	8029	5485	3.3	4.6	0	4.6	**2959**	6.23	6.90	4.48	1.5	21.5			5.9
67	12/20/2003			4.3	13.8	9.2	4.6		6.50			1.4	22.4			
68	12/21/2003			5.5	9.2	4	5.2		6.42			2.6	22.0			
69	12/22/2003	7413	5037	2.4	4	1	3		6.34	6.78	4.19	5.3	21.4			13.4
70	12/23/2003			4.2	4.6	0	4.6		6.53	6.77	4.17	3.2	21.9			
71	12/24/2003			5.8	13.8		13.8		6.67							
72	12/25/2003						0									
73	12/26/2003	8715	5834	7.4		0	0		6.64	6.55	4.53	5.3	22.5			13.2
74	12/27/2003			4.6		8.8	-8.8		6.36	6.67		2.3	22.7			
75	12/28/2003			5.6	8.8	3	5.8		6.49	6.70	4.75	2.7	22.8			
76	12/29/2003	8834	5942	1.0	3	1.5	1.5		6.56	6.58	4.40	3.9	22.7	185	21	12.3
77	12/30/2003			4.2	4.6	0.5	4.1		6.27	6.64	4.61	2.1	22.4			
78	12/31/2003	9373	6326	3.8	4.6	0.7	3.9		6.39	6.62	4.45	4.7	22.7			13.3
79	01/01/2004				9.2		9.2									
80	01/02/2004	9044	5921	5.4		4	-4		6.40	6.56	4.11	3.6	22.9			14.7
81	01/03/2004			5.2	13.8	7.1	6.7		6.46	6.73		1.4	23.1			
82	01/04/2004			5.1	7.1	2	5.1		6.02	6.49	6.50	2.1	23.6			
83	01/05/2004	9391	6212	1.9	2	0	2		6.86	7.10	5.47	2.4	22.8	200	21	20.1
84	01/06/2004			4.3	4.6	0			6.84	7.13		4.5	22.6			
85	01/07/2004	10313	6650	4.4	4.6	0			6.85	7.25	6.37	5.7	21.9			32.3
86	01/08/2004			4.8	4.6	0			7.16	7.11		6.6	22.9			
87	01/09/2004															

						Chambers Works #5 NABC
		pH controllers				
		INITIAL	FINAL	Bicarb		
DAY	DATE	Bicarb	Bicarb	con-sumed	Waste Vol	
		mL	mL	mL	mL	COMMENTS
62	12/15/2003	200	200	0		turbid, thin white foam - lowered air "50" to "35"
63	12/16/2003	200	190	10		less turbid, no foam - aerator not mixing totally, increased mix rate
64	12/17/2003	190	190	0		murky, no foam
65	12/18/2003	190	190	0		SWITCHED FEED TO 50% 2959 (NOT adding NH4Cl to new tote) -- same
66	12/19/2003	190	180	10		SWITCHED FEED ENTIRELY TO 2959 -- v. sl. Turbid, v yellow, no foam
67	12/20/2003	180	160	20		same, inc air
68	12/21/2003	160	160	0		same
69	12/22/2003	160	150	10		murky, no foam
70	12/23/2003	150	150	0		sl. Turbid. No foam
71	12/24/2003	150	145	5		sl. Turbid. No foam
72	12/25/2003	145	145	0		
73	12/26/2003	145	145	0		
74	12/27/2003	145	145	0		looks good, yellow crust on rx walls, turbid
75	12/28/2003	145	120	25		clarifier effluent is extremely turbid, almost opaque
76	12/29/2003	120	140	-20		scummy yellow film on rx edges, in addition to cw yellow film/scum. Turbid supernate
77	12/30/2003	140	130	10		turbid, scummy yellow on aerator walls, thin foam
78	12/31/2003	130	130	0		turbid; thin yellowish foam
79	01/01/2004	130	130	0		
80	01/02/2004	130	125	5		start 30% drum 2966-1 fd tubing clogged, changed & resumed feeding. V. turbid, thin white foam.
81	01/03/2004	125	125	0		very turbid, foam
82	01/04/2004	125	120	5		clarifier is very turbid
83	01/05/2004	120	105	15		start 100% drum 2966-1. Clarifier is so turbid, cannot discern interface of sludge level. Foam and yellow scum build up.
84	01/06/2004	105	120			sl. Turbid, 1/4' brown foam
85	01/07/2004	120	120			clear, some foam. Looks good
86	01/08/2004					only v. sl. Turbid, looks good. Eff saved for toxicity testing.
87	01/09/2004					**1/8 end of test. Rxs sacrificed for odor panel and cakes**

		Chambers Works #6 FSBC																
		FEED																
DAY	DATE	Feed DOC sol	COD tot	COD, sol	BOD, sol	NO2-N	NO3-N	NH3-N	TN, inst	TDS	SO4	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
1	10/15/2003													0	0.0			
2	10/16/2003	372							97									
3	10/17/2003	358		932	589				81			8.1						
4	10/18/2003																	
5	10/19/2003																	
6	10/20/2003	348	1313	1030					76			7.9						
7	10/21/2003	331							111	2900								
8	10/22/2003	333		1156	547				109			6.2	7.3	1.1	4.5			
9	10/23/2003	259							67									
10	10/24/2003	484				<1	<.5	25.8	117		1620	5.2	15.6	7.4	29.7	9.3	3.0	
11	10/25/2003																	
12	10/26/2003																	
13	10/27/2003	317	1324	1217		<1	<.5		86		1568	4.8	19.0	11.5	46.1	8.2	2.7	23.6
14	10/28/2003	229							68	2827								
15	10/29/2003	312		1292	450	<1	<.5		89		1597	1.5	19.0	14.1	56.4	10.5	3.4	
16	10/30/2003	424							100									
17	10/31/2003	370		1085		3.77	<.5		74		1460	5.0	19.9	12.3	49.3	8.0	2.6	
18	11/01/2003																	
19	11/02/2003																	
20	11/03/2003	235	1376	663		17.62	<.5		53		704	2.6	19.2	13.9	55.5	8.4	2.7	
21	11/04/2003	225							47	3693								
22	11/05/2003	228		807	221				47				20.7	18.5	74.0		2.2	
23	11/06/2003	224				11.82	<.5	9.84	43		607					6.8	2.2	
24	11/07/2003	224							41				17.0	14.8	59.2		2.2	
25	11/08/2003																	
26	11/09/2003																	
27	11/10/2003	199	682	682		<1	<.5		36		663	4.3	21.0	14.1	56.4	8.0	2.6	
28	11/11/2003	195							27	3740								
29	11/12/2003	205		615	441				26			4.1	19.3	11.2	44.9		4.0	
30	11/13/2003	190				<1	<.5	11	25		782					12.7	4.1	
31	11/14/2003	183		564					25			4.9	18.3	9.4	37.6		4.0	

		Chambers Works #6 FSBC																			
		EFFLUENT																			
DAY	DATE	Eff 6 DOC	COD tot	Eff 6 COD, sol	Eff 6 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
1	10/15/2003																				
2	10/16/2003	37					64														
3	10/17/2003	32		96	1		48	50	36		<1	7.33	1761	0.91	0.97				<2.5		
4	10/18/2003																				
5	10/19/2003																				
6	10/20/2003	53	152	105			50	5	5		1.35	7.44	1573	1.14	2.06				<2.5		
7	10/21/2003	52					60			3240											
8	10/22/2003	62		100			65	22	15		<1	<.5	1508	0.28					<2.5		
9	10/23/2003	67					71														
10	10/24/2003	37				35.4	81	15	4		<1	0.73	1559	0.9					<2.5		
11	10/25/2003																				
12	10/26/2003																				
13	10/27/2003	75	219	278			76	20	12		2.26	20.7	1619	0.99		16	12.4	49.5	8.2	2.6	13.6
14	10/28/2003	51					43			3313											
15	10/29/2003	47		118	16		30	25	14		1.85	20.08	1579	1.3	1.4	14.4	10.2	40.9	8.9	2.9	
16	10/30/2003	68					29														
17	10/31/2003	59		147			32	25	25		<1	21.97	1597	1.64		10.7	5.8	23.3	10.0	3.2	
18	11/01/2003																				
19	11/02/2003																				
20	11/03/2003	66	136	134			34	30	18		<1	26.79	1446	2.25		13.5	2.5	9.9	27.2	8.8	
21	11/04/2003	71					34			3540											
22	11/05/2003	62		323	29		29	41	28					1.8		13.2	1.1	4.4		10.3	
23	11/06/2003	56				1.62	26				<1	20.9	741	1.82					31.9	10.3	
24	11/07/2003	53					25	42	28					1.8		16	3.9	15.6		10.3	
25	11/08/2003																				
26	11/09/2003																				
27	11/10/2003	63	304	329			30	65	30		<1	21.34	677	2.9		15.5	1.7	6.8	33.8	10.9	
28	11/11/2003	65					26			3787											
29	11/12/2003	63		190	4		24	73	48					2.8		15	1.3	5.2		10.9	
30	11/13/2003	54				0.6	21				<1	20.92	743	2.8					36.9	11.9	
31	11/14/2003	53		152			19	74	41					2.8		15.1	0.4	1.6		11.9	

DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR
		Chambers Works #6 FSBC														
		UNIT PERFORMANCE			FEED VOL											
		mg/L	mg/L	L	L	L	L					mg/L		mL/L	mL/g	mg/L/hr
1	10/15/2003								7.41			4.0	23.2			
2	10/16/2003			3.3	4.6	1	3.6	2941	7.41	8.01	5.46	0.2	22.5			
3	10/17/2003	12167	7630	4.4	4.6	0.1	4.5	2941	7.22	8.03	5.65	1.1	22.7			33.8
4	10/18/2003			5.8	14.6	8.2	6.4	2941	6.96	7.84	5.96	3.0	19.9			
5	10/19/2003			5.0	8.2	3	5.2	2941	7.42	7.64	6.53	5.4	20.0			
6	10/20/2003	17174	10569	2.6	3	0	3	2941	7.60	7.80	6.04	6.4	20.0			55.3
7	10/21/2003			3.6	4.6	0.6	4	2941	7.35	7.91	5.94	1.8	20.2			
8	10/22/2003	12541	7970	4.4	4.6	0	4.6	2941	7.35	7.87	5.60	0.8	20.0			57.2
9	10/23/2003			4.4	4.6	0	4.6	2941	7.31	7.87		0.6	21.7			
10	10/24/2003	10787	7025	3.9	4.6	0.8	3.8	2941	7.23	7.99	5.84	1.6	22.7			77.9
11	10/25/2003			5.3	14.1	8	6.1	2941	7.37			0.0	22.5			
12	10/26/2003			4.8	8	3.3	4.7	2941	6.77	7.92	6.43	3.3	21.3			
13	10/27/2003	17527	11340	3.2	3.3	0	3.3	2941	6.27	7.70	6.22	4.6	20.5			46.1
14	10/28/2003			4.2	4.6	0	4.6	2941	6.59	7.58		3.0	20.1			
15	10/29/2003	15324	10199	3.8	4.6	0.8	3.8	2941	6.76	7.64	6.19	2.0	21.6			51.6
16	10/30/2003			4.2	4.6	0.2	4.4	2941	6.38	7.46	6.24	2.3	21.8			
17	10/31/2003	16435	10236	4.0	4.6	0.7	3.9	2941	6.39	7.39	6.24	3.2	22.5			35.2
18	11/01/2003			5.2	13.8	8.2	5.6	2941	6.20	6.96	6.24	2.7	21.8			
19	11/02/2003			5.2	8.2	3	5.2	2941	6.38	7.12	6.24	4.1	21.7			
20	11/03/2003	15052	9917	2.2	3	0	3	**2947-1a**	6.68	7.28	6.02	4.9	21.4			31.6
21	11/04/2003			4.0	4.6	0	4.6	**2947-1b**	6.74	7.19	5.62	6.2	20.9			
22	11/05/2003	13011	8909	4.6	4.6	0.2	4.4	2947-1b	6.56	7.03	5.72	4.6	21.5			31.3
23	11/06/2003			4.4	4.6	0	4.6	2947-1b	6.53	7.06	5.84	5.1	21.4			24.6
24	11/07/2003	10425	7070	3.8	4.6	0	4.6	**2947-1c (60%)**	6.41	6.97		5.4	22.1	220	21.1	
25	11/08/2003			5.4	13.8	8.4	5.4	2947-1c 60%	6.32	6.84	6.01	4.9	22.3			
26	11/09/2003			4.5	8.4	4	4.4	2947-1c 60%	6.40			4.0	23.8			25.6
27	11/10/2003	14190	9380	3.4	4	0	4	**2947-1c**	6.40	6.72	5.83	5.6	24.0			
28	11/11/2003			3.4	4.6	0.8	3.8	**2947-1d 50%**	6.52	6.81		4.8	23.2			
29	11/12/2003	13760	9238	4.1	4.6	0.5	4.1	2947	6.42	7.07	5.86	3.5	21.3	220	16.0	24.9
30	11/13/2003			4.1	4.6	0.5	4.1	2947	6.53	7.05	5.60	3.6	21.0			
31	11/14/2003	10097	6713	4.5	4.6	0	4.6	2947	6.49	7.00	6.64	3.9	22.8			21.5

		Chambers Works #6 FSBC				
		pH controllers				
		INITIAL	FINAL	Bicarb		
DAY	DATE	Bicarb	Bicarb	con-sumed	Waste Vol	
		mL	mL	mL	mL	COMMENTS
1	10/15/2003					Started CWWW
2	10/16/2003	250	250	0		Looks good, increased air. DO 2.2
3	10/17/2003	250	250	0		looks good, supernate turbid. Incresed air
4	10/18/2003	250	250	0		Looks good
5	10/19/2003	250	250	0		Looks good, loewred DO to 450
6	10/20/2003	250	250	0		Looks good, lowered DO to 300
7	10/21/2003	250	250	0		looks great, DO back to 300
8	10/22/2003	250	250	0		air raised from "250" to "300", looks good
9	10/23/2003	250	250	0		supernate clear, looks good
10	10/24/2003	250	250	0		same, why is pH so high?? Not from bicarb or feed. BEGAN FEEDING NCH (8.4mL FSB/4.6mL FEED)
11	10/25/2003	250	250	0		Increased air to 500. DO upto 1.2 and climbing, no foam, looks OK
12	10/26/2003	250	250	0		1/4" light colored froth on aerator
13	10/27/2003	250	250	0		supernate almost clear, thin foam in aerator, Rx looks OK
14	10/28/2003	250	250	0		same, still good.
15	10/29/2003	250	230	20		
16	10/30/2003	230	230	0	500	thin foam, slightly turbid supernate w/a few sludge chunks floating
17	10/31/2003	230	230	0	500	2" floating sludge in clarifier, thin foam in aerator, clear supernate
18	11/01/2003	230	230	0		a few sludge chunks floating in clarifier, thin dark foam in aerator, slightly turbid supernate
19	11/02/2003	230	220	10		1" heavy dark foam, 30% solids in clarifier and turbid
20	11/03/2003	220	200	20	100	1" scummy foam, clear supernate -- **SWITCHED FEED TO 2947**
21	11/04/2003	200	200	0		1/2" white foam with scum on edges of aerator, clear supernate with 60% of clarifier settled solids -- FEED DRUM CHANGED TC
22	11/05/2003	200	200	0		turbid clarifier, 1/2-1" scummy foam
23	11/06/2003	200	200	0	100	clear supernate (some floating solids) 1/2" white foam, plug left in reactor, lost ~0.8 L of effluent
24	11/07/2003	200	200	0	100	slightly turbid supernate, 1/2-1" very scummy foam -- FEED DRUM CHANGED TO 60% 1c, 40% 1b
25	11/08/2003	200	200	0		1 1/2" scummy foam, 2drops 1/10 AF
26	11/09/2003	200	200	0		1" scummy foam, 1 drop 1/10 AF
27	11/10/2003	200	200	0	100	1" scummy foam, turbid clarifier, decreased air from "550" to "450" -- FEED DRUM CHANGED TO 1c
28	11/11/2003	200	200	0		1" scummy foam, turbid clarifier, decreased air from "450" to "350" -- FEED DRUM CHANGED TO 50% 1d, 50% 1c
29	11/12/2003	200	200	0	100	1/2" scummy foam, turbid clarifier
30	11/13/2003	200	175	25		same
31	11/14/2003	175	175	0	100	same

		Chambers Works #6 FSBC																
		FEED																
DAY	DATE	Feed DOC sol	COD tot	COD, sol	BOD, sol	NO2-N	NO3-N	NH3-N	TN, inst	TDS	SO4	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
32	11/15/2003																	
33	11/16/2003																	
34	11/17/2003	154		593		<1	1.49		25		635	6.7	20.2	11.2	44.6	7.2	2.3	
35	11/18/2003	264							57	2280								
36	11/19/2003	261	869	865	493			26	55			4.3	17.1	10.5	41.8		2.3	
37	11/20/2003	232				<1	9.55		52		741					3.1	1.0	
38	11/21/2003	267							54			5.0	18.3	12.3	49.1		1.0	
39	11/22/2003																	
40	11/23/2003																	
41	11/24/2003	273		859		3.46	6.93	25	54		910		18.1	15.6	62.6	7.6	2.5	
42	11/25/2003	267							51	2353								
43	11/26/2003	266	1050	854	493	7.81	<.5		48		919	3.7	19.3	12.9	51.7	8.2	2.6	
44	11/27/2003																	
45	11/28/2003																	
46	11/29/2003																	
47	11/30/2003																	
48	12/01/2003	273		901		6.87	<.5		49		995					10.1	3.2	
49	12/02/2003	239							39	2433								
50	12/03/2003	253	842	756	493				38			2.0	22.7	17.5	69.9		3.2	23.8
51	12/04/2003	165				<1	0.65	20	25		827					3.5	1.1	
52	12/05/2003	161		588					15			6.2	18.6	11.3	45.2		1.1	
53	12/06/2003																	
54	12/07/2003																	
55	12/08/2003	157		588		<1	1.16		11		761	5.6	20.4	11.6	46.4	9.9	3.2	
56	12/09/2003	135							8	1647								
57	12/10/2003	123	530	528	125				7			6.7	17.6	7.9	31.6		3.0	19.5
58	12/11/2003	123				<1	<.5	20	22		641					9.3	3.0	
59	12/12/2003	132		486					19			6.5	22.0	12.6	50.2		3.0	
60	12/13/2003	132																
61	12/14/2003	132																

		Chambers Works #6 FSBC																			
		EFFLUENT																			
DAY	DATE	Eff 6 DOC	COD tot	Eff 6 COD, sol	Eff 6 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
32	11/15/2003																				
33	11/16/2003																				
34	11/17/2003	47		192			21	51	33		<1	19.24	705	2.95		15.7	1.7	7.0	34.1	11.0	
35	11/18/2003	48					22			4287											
36	11/19/2003	52	211	163	10	4.87	28	38	20					4.2		16.6	1.4	5.6		11.0	
37	11/20/2003	55					31				<1	25.2	853	4.15					34.7	11.2	
38	11/21/2003	62					33	39	29					4.2		16.1	0.7	2.8		11.2	
39	11/22/2003																				
40	11/23/2003																				
41	11/24/2003	92		288		10.3	29	61	56		<1	10.99	959	2.21		14.7	2.0	8.0	32.5	10.5	
42	11/25/2003	96					31			2047											
43	11/26/2003	111	349	172	79		34	91	73		<1	4.58	957	1.44		15.4	5.8	23.3	25.2	8.1	
44	11/27/2003																				
45	11/28/2003																				
46	11/29/2003																				
47	11/30/2003																				
48	12/01/2003	120		326			29	68	57		1.17	0.6	985	1.19					17.7	5.7	
49	12/02/2003	118					30			2300											
50	12/03/2003	115	389	315	62		28	76	62					1		14.8	9.3	37.2		4.5	15.4
51	12/04/2003	112				15.44	29				<1	<.5	1009	0.68					14.0	4.5	
52	12/05/2003	105		320			26	86	68					0.7		13.7	8.5	34.0		4.5	
53	12/06/2003																				
54	12/07/2003																				
55	12/08/2003	70		216			4	63	46		<1	<.5	718	1.55		14.7	6.4	25.8	20.8	6.7	
56	12/09/2003	72					5			1767											
57	12/10/2003	64	403	186	31		1							2.1		16.2	6.7	26.8		7.4	16.9
58	12/11/2003	58				5.87	0				<1	<.5	658	2.14					22.9	7.4	
59	12/12/2003	58		145			1							2.1		18.1	8.6	34.4		7.4	
60	12/13/2003	59					7														
61	12/14/2003	57					14														

		Chambers Works #6 FSBC														
		UNIT PERFORMANCE			FEED VOL											
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR
		mg/L	mg/L	L	L	L	L					mg/L		mL/L	mL/g	mg/L/hr
32	11/15/2003			4.0	13.8	9.3	4.5	2947	6.67	7.12	5.94	3.1	22.5			
33	11/16/2003			5.9	9.3	3.4	5.9	2947	6.46	7.01	6.05	3.5	22.3			
34	11/17/2003	11698	7806	2.4	3.4	1	2.4	2947	6.68	7.34	6.67	2.4	21.3			27.1
35	11/18/2003			4.5	4.6	0	4.6	**2951**	6.56	7.20	5.85	1.5	21.8			
36	11/19/2003	8765	5792	3.9	4.6	0.8	3.8	2951	6.42	7.12	5.67	1.2	21.2	230	26.2	23.9
37	11/20/2003			4.4	4.6	0	4.6	2951	6.39	7.00	6.52	1.4	21.1			
38	11/21/2003	10276	6806	4.4	4.6	0.2	4.4	2951	6.45	6.96	5.59	2.0	22.4			24.6
39	11/22/2003			4.9	13.8		13.8	2951								
40	11/23/2003			4.0	9.5	4.9	4.6	2951	6.46			1.4	22.9			
41	11/24/2003	9826	6636	4.2	4.9	0	4.9	2951	7.06	7.10	5.82	5.5	23.9			16.5
42	11/25/2003			4.2	4.6	0	4.6	2951	7.01	7.15	6.00	4.9	23.3			
43	11/26/2003	9780	6523	4.4	4.6	0	4.6	2951	7.01	7.15	5.83	4.7	21.8	240	24.5	16.4
44	11/27/2003				18.4		18.4	2951								
45	11/28/2003						0	2951								
46	11/29/2003			4.1		11.3	-11.3	2951	7.25			5.2				
47	11/30/2003			5.0	11.3	7	4.3	2951	7.28			4.9				
48	12/01/2003	9844	6664	4.6	4.6	0	4.6	2951	7.02	7.28	5.86	5.3	22.2			11.8
49	12/02/2003			4.2	4.6	0	4.6	2951-5	7.14	7.21	5.88	6.0	21.6			
50	12/03/2003	9128	6068	4.0	4.6	0	4.6	2951-5	6.92	7.18	6.54	5.8	20.7	180	19.7	12.6
51	12/04/2003			4.0	4.6	0.2	4.4	37% 2954	6.94	7.11		6.0	23.4			
52	12/05/2003	10101	6777	3.5	4.6	0.7	3.9	100% 2954	6.88	7.08	5.65	6.5	21.7			11.7
53	12/06/2003			5.2	13.8		13.8	2954	6.69				21.0			
54	12/07/2003			4.8		3.2	-3.2	2954	6.78	7.12	6.07	4.8				
55	12/08/2003	9905	6576	3.0	3.2	0	3.2	2954	6.92	7.37		5.7	22.1			13.4
56	12/09/2003			3.9	4.6	0.1	4.5	2954	6.80	7.20	5.94	4.8	21.5			
57	12/10/2003	10691	7021	4.0	4.6	0	4.6	2954	6.91	7.28	5.87	5.2	21.2			12.2
58	12/11/2003			4.3	4.6	0	4.6	2954	6.65	7.24	6.42	3.9	21.4			
59	12/12/2003	9248	6141	4.2	4.6	0	4.6	2954	6.87	7.24	6.18	3.6	21.3			10.7
60	12/13/2003			3.4	13.8	10.2	3.6	2954	6.72			4.9	21.5			
61	12/14/2003			5.5	10.2	3.5	6.7	2954	6.76			2.7	21.9			

DAY	DATE	Chambers Works #6 FSBC pH controllers INITIAL Bicarb mL	FINAL Bicarb mL	Bicarb con-sumed mL	Waste Vol mL	COMMENTS
32	11/15/2003	175	150	25		same, 2 drops 1/10 AF
33	11/16/2003	150	150	0		lowered air from "350" to "300", slightly turbid, 2" scummy foam, 2 drops 1/10 AF
34	11/17/2003	150	150	0	50	1" scummy foam, turbid supernate
35	11/18/2003	150	145	5		Switched feed to 2951 -- 1/2" scummy foam, less turbid supernate
36	11/19/2003	145	140	5	50	1/2" scummy foam, turbid clarifier
37	11/20/2003	140	100	40		same
38	11/21/2003	100	100	0	50	same
39	11/22/2003	100	100	0		same
40	11/23/2003	100	100	0		same
41	11/24/2003	100	100	0		same
42	11/25/2003	100	100	0		same
43	11/26/2003	100	100	0		same
44	11/27/2003	100	100	0		same
45	11/28/2003	100	100	0		same
46	11/29/2003	100	100	0		very murky, 1" foam
47	11/30/2003	200	200	0		same
48	12/01/2003	200	200	0		same
49	12/02/2003	200	200	0		same -- BEGAN FEEDING DRUM 5 FROM 2951
50	12/03/2003	200	200	0		turbid, 1/2" scummy foam
51	12/04/2003	200	200	0		SWITCHED FEED TO 37% 2954 -- turbid, thin scummy foam
52	12/05/2003	200	200	0		SWITCHED FEED ENTIRELY TO 2954 -- same
53	12/06/2003	200	200	0		same
54	12/07/2003	200	200	0		turbid, no foam, decreased air from "120"-"90"
55	12/08/2003	200	200	0		same
56	12/09/2003	200	200	0		turbid, no foam
57	12/10/2003	200	200	0		turbid, no foam
58	12/11/2003	200	200	0		BEGAN ADDING 10 mg/L NH4Cl-N TO FEED FOR ALL REACTORS -- same, decreased air "60" to "50"
59	12/12/2003	200	200	0		turbid, no foam
60	12/13/2003	200	200	0		slightly turbid, no foam
61	12/14/2003	200	200	0		turbid, slight orange color in clarifier

		Chambers Works #6 FSBC																
		FEED																
DAY	DATE	Feed DOC sol	COD tot	COD, sol	BOD, sol	NO2-N	NO3-N	NH3-N	TN, inst	TDS	SO4	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
62	12/15/2003	162		492		<1	<.5		26		640	7.9	19.8	7.0	28.2	15.2	4.9	
63	12/16/2003	157							26	1927								
64	12/17/2003	152	519	431	241				25			6.8	18.3	6.6	26.4		4.9	18.5
65	12/18/2003	186				<1	7.03	26	43		1347					15.0	4.8	
66	12/19/2003	232		794					60			1.0	11.5	10.5	42.0			
67	12/20/2003																	
68	12/21/2003																	
69	12/22/2003	214	853	783		<1	14.32		58		1942	1.3	10.5	5.5	22.2	11.4	3.7	
70	12/23/2003	236							62	5433								
71	12/24/2003																	
72	12/25/2003																	
73	12/26/2003	236			424	<1	14.23				1929					3.2	1.0	
74	12/27/2003																	
75	12/28/2003																	
76	12/29/2003	229		816		<1	14.35		64		1952	0.7	16.1	13.1	52.3	7.1	2.3	17.5
77	12/30/2003	197						29	49	5740								
78	12/31/2003	231	850	635	422				60			0.3	10.9	8.3	33.1		2.3	
79	01/01/2004																	
80	01/02/2004	238		642		<1	14.31		61		1941					3.4		
81	01/03/2004																	
82	01/04/2004																	
83	01/05/2004	301		999		<1	<.5		59		2419	6.7	19.4	12.7	51.0	16.8		
84	01/06/2004	315							60	8447								
85	01/07/2004	313	1334	1020	482				60			3.4	19.4					
86	01/08/2004	313																
87	01/09/2004																	

		Chambers Works #6 FSBC																			
		EFFLUENT																			
DAY	DATE	Eff 6 DOC	COD tot	Eff 6 COD, sol	Eff 6 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
62	12/15/2003	53		134			9				<1	<.5	684	2.67		17.3	5.7	22.9	27.5	8.9	
63	12/16/2003	63					15			1700											
64	12/17/2003	64	176	65	36		14	49	35							13.8	4.9	19.6		8.9	16.5
65	12/18/2003	63				15.08	13				<1	<.5	658	2.96					29.2	9.4	
66	12/19/2003	67		177			25	44	32							17.8	17.8	71.2			
67	12/20/2003																				
68	12/21/2003																				
69	12/22/2003	75	200	229			44	42	28		<1	<.5	1921	0.9		9.8	4.2	17.0	14.4	4.7	
70	12/23/2003	75					40														
71	12/24/2003																				
72	12/25/2003																				
73	12/26/2003	72		202	32		38	32	20		<1	<.5	2040	0.9		8.3	4.4	17.8	9.2	3.0	
74	12/27/2003																				
75	12/28/2003																				
76	12/29/2003	76		224			38	36	28		<1	<.5	1980	0.9		12.1	8.8	35.1	7.5	2.4	11.6
77	12/30/2003	86				24.47	41			5260											
78	12/31/2003	85	250	219	40		31	35	20							12.4	12.4	49.6			
79	01/01/2004																				
80	01/02/2004	76		161			34	26	15		<1	<.5	1977	<1		10.2	10.2	40.8	12.4	4.0	
81	01/03/2004	85					41														
82	01/04/2004	89					44														
83	01/05/2004	92		243			51	42	22		<1	4.5	2133			14	10.9	43.7	9.5	3.1	
84	01/06/2004	92					49			7167											
85	01/07/2004	98	312	282	39	27.8	46	44	20							14.5	14.5	58.0			
86	01/08/2004	91					40				<1	<.5	2725	<1					18.8		
87	01/09/2004																				

		Chambers Works #6 FSBC															
		UNIT PERFORMANCE			FEED VOL												
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR
		mg/L	mg/L	L	L	L	L					mg/L		mL/L	mL/g	mg/L/hr
62	12/15/2003	11711	7902	3.3	3.5	0	3.5	2954	6.25	7.29	5.09	3.1	21.3			8.2
63	12/16/2003			4.6	4.6	0	4.6	2954	6.69	7.27	5.09	3.0	21.4			
64	12/17/2003	11366	7777	4.3	4.6	0	4.6	2954	6.60	7.22	4.71	2.6	21.4	200	17.6	9.6
65	12/18/2003			4.0	4.6	0	4.6	50% 2959	6.41	7.10	4.83	2.1	20.5			
66	12/19/2003	10633	7270	3.3	4.6	0	4.6	2959	6.33	6.98	4.65	2.8	21.3			7.2
67	12/20/2003			4.2	13.8	9.1	4.7	2959	6.23			1.9	22.4			
68	12/21/2003			5.5	9.1	3.8	5.3	2959	6.37			1.4	22.0			
69	12/22/2003	10871	7333	3.1	3.9	0	3.9	2959	6.22	6.76	4.66	2.4	21.5			18.2
70	12/23/2003			3.8	4.6	0.3	4.3	2959	6.45	6.85	4.72	1.2	21.9			
71	12/24/2003			5.6	13.8	8.2	5.6	2959	6.57							
72	12/25/2003						0	2959								15.4
73	12/26/2003	10704	7198	6.7		1	-1	2959	6.65	6.78	4.86	2.8	22.6			
74	12/27/2003			4.2	13.8		13.8	2959	6.50	6.89		1.2	22.6			
75	12/28/2003			5.3		3.3	-3.3	2959	6.44	6.83	4.68	0.8	22.8			
76	12/29/2003	11820	8016	2.0	3.3	0.5	2.8	2959	6.51	6.79	4.51	2.0	22.4	250	21.2	17.4
77	12/30/2003			3.8	4.6	0	4.6	2959	6.33	6.87	4.21	1.7	22.3			
78	12/31/2003	11123	7567	3.8	4.6	0.3	4.3	2959	6.37	6.84	4.41	1.9	22.6			16.7
79	01/01/2004				9.2	5	4.2	2959								
80	01/02/2004	11291	7634	8.3	5	0	5	2959/2966	6.42	6.67	4.50	0.8	22.7			19.2
81	01/03/2004			4.8	13.8	8	5.8	2959/2967	6.63	6.98		0.4	22.9			
82	01/04/2004			4.6	8	3.4	4.6	2959/2968	6.37	7.13	6.06	5.3	23.3			
83	01/05/2004	11314	7647	2.8	3.4	0	3.4	2966	6.87	7.22	5.55	5.7	22.4	230	20.3	15.2
84	01/06/2004			3.9	4.6	0.5	4.1	2966	6.91	7.24		5.5	22.1			
85	01/07/2004	11127	7481	3.9	4.6	0	4.6	2966	6.84	7.43	6.42	6.4	21.7			19
86	01/08/2004			3.9	4.6	0.7	3.9	2966	6.97	7.43		4.6	22.6			
87	01/09/2004			4.0			0	2966		7.37						

DAY	DATE	pH controllers INITIAL Bicarb mL	FINAL Bicarb mL	Bicarb con-sumed mL	Waste Vol mL	COMMENTS
62	12/15/2003	200	200	0		SWITCHED NCH LOAD TO SAME AS Rx 7 (FB - 8mL treated sample / 4.6L feed) -- slightly turbid, no foam, lowered air "50" to "
63	12/16/2003	200	200	0		same
64	12/17/2003	200	200	0		medium turbidity; no foam
65	12/18/2003	200	200	0		SWITCHED TO 50% 2959 (NOT adding NH4CL to new tote) -- medium turbidity; no foam
66	12/19/2003	200	200	0		SWITCHED ENTIRELY TO 2959 -- murky; no foam
67	12/20/2003	200	200	0		turbid; adjusted pH controller because reactor pH was too low
68	12/21/2003			0		turbid; no foam
69	12/22/2003	200	190	10		murky; no foam
70	12/23/2003	190	190	0		murky; no foam
71	12/24/2003	190	180	10		slight turbidity
72	12/25/2003	180	180	0		
73	12/26/2003	180	180	0		
74	12/27/2003	180	180	0		turbid
75	12/28/2003	180	175	5		clarifier effluent is extremely turbid - similar to unit # 5; increased air flow to 200
76	12/29/2003	175	175	0		same as above
77	12/30/2003	175	175	0		slight turbidity - ok
78	12/31/2003	175	170	5		Murky, no foam
79	01/01/2004	170	170	0		
80	01/02/2004	170	170	0		start 30% drum 2966-1. Very turbid
81	01/03/2004	170	170	0		Very turbid
82	01/04/2004	170	170	0		Clarifier slightly less turbid than Unit 5
83	01/05/2004	170	170	0		Very turbid, similar to #5. 100% 2966 drum
84	01/06/2004	170	170	0		Slightly turbid, less than 5. This white foam
85	01/07/2004	170	170	0		Very clear supernate. Some foam. Settled great Lowered air
86	01/08/2004	170		170		Very slight turbidity, looks nice. Eff saved for toxicity testing
87	01/09/2004					**End of test 1/8 Rxs sacrificed for cakes and odor panel.**

		Chambers Works #7 FBC																
		FEED																
DAY	DATE	Feed DOC sol	COD tot	COD, sol	BOD, sol	NO2-N	NO3-N	NH3-N	TN, inst	TDS	SO4	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
1	10/15/2003																	
2	10/16/2003	372							97									
3	10/17/2003	358		932	589				81			8.1						
4	10/18/2003																	
5	10/19/2003																	
6	10/20/2003	348	1313	1030					76			7.9						
7	10/21/2003	331							111	2853								
8	10/22/2003	333		1156	547				109			6.2	7.3	1.1	4.5			
9	10/23/2003	259							67									
10	10/24/2003	504				<1	<.5	28.5	111		1621	4.6	18.8	11.4	45.8	9	2.77	
11	10/25/2003																	
12	10/26/2003																	
13	10/27/2003	321	1462	1124		<1	<.5		91		1556	4.9	15.5	8.2	32.9	7.28	2.35	17.9
14	10/28/2003	217							63	2833								
15	10/29/2003	208		1188	333	<1	<.5		51		1550	3.5	12.6	7.4	29.5	5.45	1.76	
16	10/30/2003	293							56									
17	10/31/2003	233		1086		3.59	<.5		36		1438	6.1	18.3	9.2	36.6	9.46	3.05	
18	11/01/2003																	
19	11/02/2003																	
20	11/03/2003	253	872	718		18.96	<.5		55		1447	4.2	18.2	10.4	41.7	11.08	3.58	
21	11/04/2003	238							49	3667								
22	11/05/2003	245		1082	207				48				21.2	21.2	84.8		0.00	
23	11/06/2003	200				11.74	<.5	12.77	39		555					<2.5	0.00	
24	11/07/2003	227							41			5.7	17.6	11.9	47.7		0.00	
25	11/08/2003																	
26	11/09/2003																	
27	11/10/2003	232	770	653		<1	<.5		41		680	5.4	21.7	12.1	48.6	13	4.16	
28	11/11/2003	220							30	3820								
29	11/12/2003	211		594	444				30			3.3	17.0	6.8	27.3		6.90	
30	11/13/2003	217				<1	<.5	12	32		608					21	6.86	
31	11/14/2003	214		655					30			5.1	20.7	8.8	35.0		6.90	

		Chambers Works #7 FBC																			
		EFFLUENT																			
DAY	DATE	Eff 7 DOC	COD tot	Eff 7 COD, sol	Eff 7 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
1	10/15/2003																				
2	10/16/2003	48					73														
3	10/17/2003	37		92	1		61	43	29		<1	20.44	1764	1.15	1.13				<2.5		
4	10/18/2003																				
5	10/19/2003																				
6	10/20/2003	42	177	80			55	48	23		4.08	39.47	1599	3.89	4.56				<2.5		
7	10/21/2003	67					71			3507											
8	10/22/2003	87		64			77	56	36		1.22	49.36	1560	3.92					<2.5		
9	10/23/2003	94					77														
10	10/24/2003	83				1.16	79	68	42		<1	49.45	1549	3.53					<2.5		
11	10/25/2003																				
12	10/26/2003																				
13	10/27/2003	78	342	155		21.95	81	129	91		<1	38.2	1625	2.72		15.9	10.6	42.4	8.02	2.59	19.8
14	10/28/2003	74					82			3067											
15	10/29/2003	78		280	22		81	169	111		<1	27.57	1562	2.59		15.1	10.3	41.3	6.78	2.19	
16	10/30/2003	103					75														
17	10/31/2003	108		167			76	105	67		<1	22.67	1548	2.45		10.2	6.6	26.3	3.61	1.17	
18	11/01/2003																				
19	11/02/2003																				
20	11/03/2003	81	216	242			57	54	35		<1	27.33	1426	4.02		13.9	8.3	33.1	5	1.61	
21	11/04/2003	86					55			3540											
22	11/05/2003	73		329	19		43	84	52							14.5	11.6	46.4		2.90	
23	11/06/2003	74				1.39	38				<1	32.79	705	3.85					9.06	2.93	
24	11/07/2003	75					36	52	27							15.8	12.9	51.6		2.90	
25	11/08/2003																				
26	11/09/2003																				
27	11/10/2003	73	256	219			31	64	20		<1	21.01	694	4.21		15.8	2.4	9.7	28.36	9.16	
28	11/11/2003	74					23			3653											
29	11/12/2003	71		211	1		18	66	34							14.9	4.5	18.0		10.40	
30	11/13/2003	64				0.74	19				<1	17.73	740	3.66					32.23	10.41	
31	11/14/2003	66		229			18	63	37							14.3	3.9	15.6		10.40	

		Chambers Works #7 FBC														
		UNIT PERFORMANCE			FEED VOL											
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR
		mg/L	mg/L	L	L	L	L					mg/L		mL/L	mL/g	mg/L/hr
1	10/15/2003								**7.57**			5.3	22.8			
2	10/16/2003			4.0	4.6	0.4	4.2	2941	7.14	7.83	5.46	1.3	22.3			
3	10/17/2003	12936	8149	4.4	4.6	0.2	4.4	2941	7.23	7.88	5.65	0.4	22.3			34.9
4	10/18/2003			5.7	14.6	9.5	5.1	2941	6.69	7.62	5.97	2.5	21.3			
5	10/19/2003			5.0	9.5	4.6	4.9	2941	6.36	7.00	6.73	3.4	20.3			
6	10/20/2003	14432	8187	3.5	4.6	0	4.6	2941	6.25	6.70	6.04	4.0	20.0			34.7
7	10/21/2003			4.0	4.6	0.4	4.2	2941	6.32	6.83	5.94	2.9	20.3			
8	10/22/2003	13855	8444	4.5	4.6	0	4.6	2941	6.46	6.83	5.60	3.7	20.2			36.2
9	10/23/2003			4.6	4.6	0	4.6	2941	6.45	6.74		3.4	22.4			
10	10/24/2003	15642	8962	4.6	4.6	0.5	4.1	2941	5.91	6.71	5.37	3.5	23.4			46.4
11	10/25/2003			5.6	14	8.2	5.8	2941	6.56			3.0	22.9			
12	10/26/2003			4.8	8.2	3	5.2	2941	6.61	6.90	6.12	3.4	21.6			
13	10/27/2003	13908	8912	2.9	3	0	3	2941	6.44	6.88	5.91	5.5	20.7			52
14	10/28/2003			4.6	4.6	0.5	4.1	2941	6.78	6.86		4.9	22.5			
15	10/29/2003	11792	7586	4.5	4.6	0.2	4.4	2941	7.07	7.13	6.07	5.2	22.2			48.9
16	10/30/2003			4.6	4.6	0	4.6	2941	7.10	7.23		4.6	22.1			
17	10/31/2003	11534	6727	4.0	4.6	0	4.6	2941	7.06	7.36	6.07	4.3	22.8			25.8
18	11/01/2003			5.7	13.8	8.5	5.3	2941	6.38	7.00	6.07	2.1	21.8			
19	11/02/2003			5.2	8.5	3	5.5	2941	6.56	6.65	6.07	5.4	21.6			
20	11/03/2003	10284	6552	2.6	3	0	3	**2947-1a**	6.41	6.73	5.60	6.0	21.1			22
21	11/04/2003			4.4	4.6	0	4.6	**2947-1b**	6.37	6.65	5.24	6.0	20.9			
22	11/05/2003	10519	7120	4.7	4.6	0	4.6	2947-1b	6.54	6.71	5.18	5.7	21.4			16.6
23	11/06/2003			4.5	4.6	0	4.6	2947-1b	6.30	6.72	5.26	6.2	21.4			
24	11/07/2003	10687	7063	4.5	4.6	0	4.6	**2947-1c 60%**	6.41	6.74		6.6	22.1	180	17	16.3
25	11/08/2003			5.5	13.8	8.7	5.1	2947-1c 60%	6.35	6.69	5.79	6.4	22.2			
26	11/09/2003			4.5	8.7	4	4.7	2947-1c 60%	6.36			5.0	23.5			
27	11/10/2003	10089	6422	3.9	4	0	4	**2947-1c**	6.33	6.67	5.59	6.7	23.7			15.1
28	11/11/2003			4.1	4.6	0	4.6	**2947-1d 50%**	6.40	6.72		6.0	23.0			
29	11/12/2003	9794	6496	4.1	4.6	0.2	4.4	2947	6.37	7.01	5.64	4.3	21.6	190	19	16.2
30	11/13/2003			4.4	4.6	0	4.6	2947	6.55	7.00	4.98	4.4	21.3			
31	11/14/2003	8997	5938	4.6	4.6	0.2	4.4	2947	6.40	6.96	6.18	4.7	22.7			15.8

						Chambers Works #7 FBC
		pH controllers				
		INITIAL	FINAL	Bicarb		
DAY	DATE	Bicarb	Bicarb	con-sumed	Waste Vol	
		mL	mL	mL	mL	COMMENTS
1	10/15/2003					Started CWWW
2	10/16/2003	250	250	0		Looks good
3	10/17/2003	250	250	0		Turbid super, looks good, increased air
4	10/18/2003	250	250	0		Some foam
5	10/19/2003	250	250	0		Same
6	10/20/2003	250	250	0		Rx looks good, thin foam, lowered DO to 350
7	10/21/2003	250	230	20		This foam, super slite murky. Rx looks good
8	10/22/2003	230	220	10		1/2" scummy foam, looks good
9	10/23/2003	220	200	20		1/2" scummy foam,turbid clarifier
10	10/24/2003	200	180	20		low pH alarm. Pump set too low, not pumping, increased rate, 1" scummy foam, BEGAN FEEDING NCH (8.0mL FB/4.6mL FEED)
11	10/25/2003	180	170	10		some foam, lot of black foam after cleaning, added antifoam
12	10/26/2003	170	150	20		2" dark black foam, added 1 drop 1/10 antifoam, turbid clarifier
13	10/27/2003	150	150	0		turbid clarifier, foamy scummy aerator
14	10/28/2003	150	150	0		same. Added 2 drops 1/10 antifoam
15	10/29/2003	150	150	0		scummy sludge to top of Rx
16	10/30/2003	150	150	0	250	same
17	10/31/2003	150	150	0	500	1-2" scummy foam, almost opaque clarifier, added 1 drop 1/10 AF
18	11/01/2003	150	150	0		1" foam in aerator, turbid supernate
19	11/02/2003	150	150	0		2" scummy foa m, alost opaque clarifier, 1drop 1/10 AF
20	11/03/2003	150	150	0	100	lowered air flow to "200", Scum on walls to top of Rx, turbid supernate -- **SWITCHED FEED TO 2947**
21	11/04/2003	150	140	10		medium turbid supernate w/1/2" scummy foam in aerator, lowered air flow from "325" to "250" -- FEED DRUM CHANGED TO 1b
22	11/05/2003	140	125	15		very turbid clarifier, 1" scummy foam
23	11/06/2003	125	125	0		1-2" scummy foam, nearly to top of Rx
24	11/07/2003	125	120	5	100	FEED DRUM CHANGED TO 60% 1c, 40% 1b -- same
25	11/08/2003	120	110	10		Scummy foam to top of Rx, 2drops of 1/10 AF
26	11/09/2003	110	110	0		Scummy foam to top of Rx, 2 drops 1/10 AF
27	11/10/2003	110	100	10	100	FEED DRUM CHANGED TO 1c -- less foam today, turbid supernate, decreased air from "350" to "225"
28	11/11/2003	100	100	0		FEED DRUM CHANGED TO 50% 1d, 50% 1c -- 1 1/2" scummy foam with scum caked on walls to 2", turbid supernate, decreased air from "225" t
29	11/12/2003	100	100	0	100	1 1/2" scummy foam, turbid clarifier
30	11/13/2003	100	75	25		same
31	11/14/2003	250	240	10	100	same

		Chambers Works #7 FBC																
		FEED																
DAY	DATE	Feed DOC sol	COD tot	COD, sol	BOD, sol	NO2-N	NO3-N	NH3-N	TN, inst	TDS	SO4	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
32	11/15/2003																	
33	11/16/2003																	
34	11/17/2003	174		630		<1	1.45		29		657	6.9	19.2	8.5	33.9	12	3.81	
35	11/18/2003	277							59	2193								
36	11/19/2003	292	925	911	448				61			6.2	17.6	7.6	30.5		3.80	
37	11/20/2003	258				<1	9.95	25	54		764					8	2.66	
38	11/21/2003	287							58			5.7	17.0	8.6	34.3		2.70	
39	11/22/2003																	
40	11/23/2003																	
41	11/24/2003	287		891		3.47	7.14		56		924		18.7	15.0	59.8	12	3.75	
42	11/25/2003	291						25	58	2193								
43	11/26/2003	271	946	857	448	7.78	<.5		51		915	4.9	15.4	7.6	30.4	9	2.91	
44	11/27/2003																	
45	11/28/2003																	
46	11/29/2003																	
47	11/30/2003																	
48	12/01/2003	259		889		6.71	<.5		48		940					11	3.59	
49	12/02/2003	257							41	2360								
50	12/03/2003	250	838	749	448				41			2.2	13.9	9.5	38.1		2.20	15.8
51	12/04/2003	200				<1	0.66	20	31		836					7	2.17	
52	12/05/2003	177		596					16			5.7	17.5	9.6	38.5		2.20	
53	12/06/2003																	
54	12/07/2003																	
55	12/08/2003	168		562		<1	1.17		13		738	6.7	18.8	6.8	27.1	16	5.29	
56	12/09/2003	163							12	1767								
57	12/10/2003	157	621	557	150				13			7.6	18.0	5.4	21.7		5.00	17.9
58	12/11/2003	147				<1	<.5	20	26		646					16	5.04	
59	12/12/2003	158		477					24			6.0	23.8	12.8	51.2		5.00	
60	12/13/2003	158																
61	12/14/2003	158																

		Chambers Works #7 FBC																			
		EFFLUENT																			
DAY	DATE	Eff 7 DOC	COD tot	Eff 7 COD, sol	Eff 7 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
32	11/15/2003																				
33	11/16/2003																				
34	11/17/2003	56		225			22	59	32		<1	19.77	725	3.74		15.5	1.9	7.6	30.56	9.87	
35	11/18/2003	60					23			4040											
36	11/19/2003	65	239	142	11		31	42	19							17.2	7.3	29.2		9.90	
37	11/20/2003	71				2.44	36				<1	29.71	853	3.63					31.16	10.06	
38	11/21/2003	75					39	42	27							14.9	4.9	19.6		10.00	
39	11/22/2003																				
40	11/23/2003																				
41	11/24/2003	75		203			35	68	49		<1	32.05	969	2.1		14.4	1.5	6.0	33.43	10.80	
42	11/25/2003	83				3.02	36			2333											
43	11/26/2003	97	302	252	33		40	91	63		<1	24.79	973	1.84		15.3	3.2	12.7	31.84	10.28	
44	11/27/2003																				
45	11/28/2003																				
46	11/29/2003																				
47	11/30/2003																				
48	12/01/2003	116		284			42	96	60		<1	6.9	978	1.36					24.89	8.04	
49	12/02/2003	112					39			2500											
50	12/03/2003	117	390	284	67		39	116	72							14.8	7.7	30.8		7.10	15.0
51	12/04/2003	117		`		17.49	38				<1	2.24	1025	0.59					21.98	7.10	
52	12/05/2003	109		310			34	96	62							13.8	6.7	26.8		7.10	
53	12/06/2003																				
54	12/07/2003																				
55	12/08/2003	92		250			13	35	15		<1	1.29	716	1.41		13.5	3.9	15.7	25.29	8.17	
56	12/09/2003	75					8			1713											
57	12/10/2003	68	230	162	16		3									14.7	6.7	26.8		8.00	15.4
58	12/11/2003	71				5.04	3				<1	1.17	672	2.27					24.81	8.01	
59	12/12/2003	70		167			4									17.8	9.8	39.2		8.00	
60	12/13/2003	67					9														
61	12/14/2003	61					15														

		Chambers Works #7 FBC														
		UNIT PERFORMANCE			FEED VOL											
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR
		mg/L	mg/L	L	L	L	L					mg/L		mL/L	mL/g	mg/L/hr
32	11/15/2003			4.0	13.8	10	3.8	2947	6.47	7.06	5.73	4.1	22.5			
33	11/16/2003			5.9	10	3.8	6.2	2947	6.46	6.89	5.71	3.8	22.7			
34	11/17/2003	9922	6486	3.2	3.8	0	3.8	2947	6.45	7.31	6.38	4.1	21.5			18.6
35	11/18/2003			4.7	4.6	0.2	4.4	**2951**	6.65	7.20	5.06	1.2	21.5			
36	11/19/2003	8372	5483	4.4	4.6	0	4.6	2951	6.63	7.21	4.92	0.9	21.3	170	20	20.2
37	11/20/2003			4.3	4.6	0	4.6	2951	6.67	7.20	5.67	2.7	21.3			
38	11/21/2003	8464	5575	4.6	4.6	0.1	4.5	2951	6.64	7.18	5.28	1.9	22.3			24.4
39	11/22/2003			5.0	13.8		13.8	2951								
40	11/23/2003			4.0	9.5	5	4.5	2951	6.51			2.2	23.1			
41	11/24/2003	7942	5248	4.4	5	0	5	2951	6.79	7.09	5.15	3.8	23.5			20.7
42	11/25/2003			4.2	4.6	0	4.6	2951	6.65	7.16	5.46	3.8	22.8			
43	11/26/2003	8800	5908	4.2	4.6	0	4.6	2951	6.56	7.02	5.57	4.6	21.0	170	19	17.6
44	11/27/2003				18.4		18.4	2951								
45	11/28/2003						0	2951								
46	11/29/2003			3.8		5.5	-5.5	2951								
47	11/30/2003			4.1	5.5	1	4.5	2951	6.86			4.1	22.2			
48	12/01/2003	6856	4632	4.4	4.6	0	4.6	2951	6.64	7.21	5.69	4.2	21.5			13.7
49	12/02/2003			4.1	4.6	0	4.6	2951-5	6.68	7.19	5.50	4.6	21.1			
50	12/03/2003	7105	4701	4.0	4.6	0.3	4.3	2951-5	6.68	7.08	6.20	4.7	23.3	160	23	12.2
51	12/04/2003			4.0	4.6	0.5	4.1	37% 2954	6.76	7.04		5.0	21.7			
52	12/05/2003	8495	5753	3.9	4.6	0	4.6	100% 2954	6.73	7.12	5.00	6.3	21.3			10.2
53	12/06/2003			4.8	13.8		13.8	2954	6.55							
54	12/07/2003			4.2		4.5	-4.5	2954	6.73	7.07	5.45	5.3	22.0			
55	12/08/2003	8352	5558	3.5	4.5	0.2	4.3	2954	6.58	7.04		3.7	21.2			14.2
56	12/09/2003			3.7	4.6	0.5	4.1	2954	6.76	6.88	5.06	5.7	21.4			
57	12/10/2003	8095	5498	4.2	4.6	0	4.6	2954	6.57	7.08	4.99	5.5	21.2			9.5
58	12/11/2003			4.1	4.6	0	4.6	2954	6.53	7.11	5.23	5.1	21.3			
59	12/12/2003	8294	5671	4.3	4.6	0	4.6	2954	6.68	7.19	5.37	2.8	21.3			7.5
60	12/13/2003			4.0	13.8	10	3.8	2954	6.42			3.7	21.4			
61	12/14/2003			5.0	10	5	5	2954	6.51			1.8	21.9			

						Chambers Works #7 FBC
		pH controllers				
		INITIAL	FINAL	Bicarb		
DAY	DATE	Bicarb	Bicarb	con-sumed	Waste Vol	
		mL	mL	mL	mL	COMMENTS
32	11/15/2003	240	230	10		same, 2 drops 1/10 AF
33	11/16/2003	230	225	5		lowered air from "100" to "80", turbid, 2 1/2" scummy foam, 2 drops 1/10 AF
34	11/17/2003	225	200	25	50	same
35	11/18/2003	200	195	5		Switched feed to 2951 -- 1/2" very scummy foam, turbid supernate
36	11/19/2003	195	175	20	50	1" scummy foam, turbid clarifier
37	11/20/2003	175	150	25		same
38	11/21/2003	150	150	0	50	same
39	11/22/2003	150	150	0		same, lowered feed rate to "8"
40	11/23/2003	150	110	40		turbid, no foam
41	11/24/2003	110	100	10		same, some floating solids in clarifier
42	11/25/2003	100	75	25		turbid clarifier, thin scummy foam
43	11/26/2003	75	75	0		turbid, no foam
44	11/27/2003	250	250	0		same
45	11/28/2003	250	250	0		same
46	11/29/2003	250	250	0		murky supernate, scum layer on clarifier, 1/2" foam
47	11/30/2003	250	250	0		floating solids in clarifier, murky, scummy foam
48	12/01/2003	250	250	0		slightly turbid, no floating solids, scummy foam
49	12/02/2003	250	250	0		turbid, thin foam -- BEGAN FEEDING DRUM 5 FROM 2951
50	12/03/2003	250	245	5		same
51	12/04/2003	245	240	5		SWITCHED FEED TO 37% 2954 -- turbid, thin white foam
52	12/05/2003	240	250	-10		SWITCHED FEED ENTIRELY TO 2954 -- same
53	12/06/2003	250	240	10		same
54	12/07/2003	240	225	15		same, decreased air from "20" to "50"
55	12/08/2003	225	225	0		mixer not mixing, clear supernate, no foam
56	12/09/2003	225	225	0		lowered air, slight turbidity, no foam
57	12/10/2003	225	225	0		slightly turbid, no foam
58	12/11/2003	225	225	0		BEGAN ADDING 10 mg/L NH4Cl-N TO FEED FOR ALL REACTORS -- same, decreased air "20" to "15"
59	12/12/2003	225	225	0		turbid, no foam
60	12/13/2003	225	210	15		slightly less turbid, no foam
61	12/14/2003	210	210	0		same

		Chambers Works #7 FBC																
		FEED																
DAY	DATE	Feed DOC sol	COD tot	COD, sol	BOD, sol	NO2-N	NO3-N	NH3-N	TN, inst	TDS	SO4	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
62	12/15/2003	174		545		<1	<.5		28		652	7.6	19.3	6.3	25.2	17	5.44	
63	12/16/2003	159							27	1887								
64	12/17/2003	151	458	430	247				26			6.1	16.7	5.2	20.7		5.40	17.6
65	12/18/2003	160				<1	7.09	26	39		1331					3	1.10	
66	12/19/2003	220		771					58			0.4	18.8	18.4	73.7			
67	12/20/2003																	
68	12/21/2003																	
69	12/22/2003	202	819	775		<1	14.28		56		1951	0.6	10.2	8.6	34.4	3	0.99	
70	12/23/2003	224							62	5680								
71	12/24/2003																	
72	12/25/2003																	
73	12/26/2003	224			403	<1	14.32				1945					3	1.09	
74	12/27/2003																	
75	12/28/2003																	
76	12/29/2003	207		764		<1	14.18		61		1926	1.2	11.9	8.9	35.4	6	1.80	12.6
77	12/30/2003	186						29	47	5500								
78	12/31/2003	226	929	612	372				57			0.2	9.9	7.9	31.7		1.80	
79	01/01/2004																	
80	01/02/2004	200		525		<1	14.2		59		1929					6	1.96	
81	01/03/2004																	
82	01/04/2004																	
83	01/05/2004	282		960		<1	<.5		54		2424	6.3	17.9	8.3	33.1	10	3.33	
84	01/06/2004	304							58	8293								
85	01/07/2004	292	1130	986	490				56			3.6	15.3					
86	01/08/2004	292																
87	01/09/2004																	

		Chambers Works #7 FBC																			
		EFFLUENT																			
DAY	DATE	Eff 7 DOC	COD tot	Eff 7 COD, sol	Eff 7 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
62	12/15/2003	58		177			11				<1	0.92	729	3		16.4	2.8	11.1	32.88	10.62	
63	12/16/2003	59					11			1767											
64	12/17/2003	65	153	138	34		16	60	37							14.6	4.0	16.0		10.60	16.1
65	12/18/2003	76				18.75	19				<1	0.53	667	3.57					30.1	9.72	
66	12/19/2003	68		200			30	46	31							13.2	13.2	52.8			
67	12/20/2003																				
68	12/21/2003																				
69	12/22/2003	75	252	281			49	39	19		<1	3.07	1918	1.7		9.3	4.4	17.4	10.05	3.25	
70	12/23/2003	79					51														
71	12/24/2003																				
72	12/25/2003																				
73	12/26/2003	66		234	50		48	70	43		<1	<.5	2064	0.9		8.9	5.6	22.4	7.42	2.40	
74	12/27/2003																				
75	12/28/2003																				
76	12/29/2003	55		192			50	41	17		<1	10.48	2020	0.9		11	7.9	31.6	6.8	2.20	10.1
77	12/30/2003	60				26.78	57			5593											
78	12/31/2003	68	278	153	38		56	54	31							10.5	8.3	33.2		2.20	
79	01/01/2004																				
80	01/02/2004	74		169			63	77	37		<1	13.12	2006	<1		9.9	9.9	39.6	8.78	2.84	
81	01/03/2004	71					52														
82	01/04/2004	72					50														
83	01/05/2004	72		254			51	50	25		<1	7.81	2166	<1		10.2	10.2	40.8	6.77	2.19	
84	01/06/2004	76					45			6913											
85	01/07/2004	80	334	262	44	28.21	44	89	53							12.9	10.2	40.8			
86	01/08/2004	76					40				1.69	<.5	2730	<1					17.59		
87	01/09/2004																				

		Chambers Works #7 FBC														
		UNIT PERFORMANCE			FEED VOL											
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR
		mg/L	mg/L	L	L	L	L					mg/L		mL/L	mL/g	mg/L/hr
62	12/15/2003	8457	5800	3.9	5	0	5	2954	6.60	7.22	5.09	1.7	21.4			8.2
63	12/16/2003			4.5	4.6	0	4.6	2954	6.47	7.24	4.81	2.9	21.5			
64	12/17/2003	8117	5707	4.2	4.6	0	4.6	2954	6.53	7.03	4.76	3.5	21.2	170	21	6.4
65	12/18/2003			4.1	4.6	0.5	4.1	50% 2959	6.48	7.02	5.76	2.9	20.4			
66	12/19/2003	8190	5666	3.2	4.6	0	4.6	2959	6.42	7.08	5.07	2.8	21.1			8.6
67	12/20/2003			4.0	13.8	10	3.8	2959	6.27			4.9	22.3			
68	12/21/2003				10	4.5	5.5	2959	6.28			0.9	20.9			
69	12/22/2003	5043	3425	3.6	4.5	0.5	4	2959	6.13	6.67	4.78	4.5	21.1			9.2
70	12/23/2003			4.3	4.6	0	4.6	2959	6.40	6.73	4.82	2.8	21.6			
71	12/24/2003			5.7	13.8	8	5.8	2959	6.39							
72	12/25/2003						0	2959								
73	12/26/2003	6381	4276	7.3		0.4	-0.4	2959	6.51	6.60	4.89	1.9	22.5			
74	12/27/2003			3.7	13.8	9	4.8	2959	6.45	6.95		0.6	22.5			
75	12/28/2003			6.0	9	3	6	2959	6.37	6.67	4.78	6.3	22.5			
76	12/29/2003	6944	4670	2.4	3	0	3	2959	6.30	6.50	4.64	6.7	18.4	140	20	18.4
77	12/30/2003			4.1	4.6	0	4.6	2959	6.56	7.15	4.37	3.0	22.2			
78	12/31/2003	6546	4391	3.8	4.6	0	4.6	2959	6.74	7.07	4.65	3.6	22.7			14.3
79	01/01/2004				9.2	5	4.2	2959								
80	01/02/2004	6710	4450	8.4	5	0	5	2959/2966	6.50	6.80	4.58	2.4	22.7			11.3
81	01/03/2004			5.0	13.8	8	5.8	2959/2967	6.73	7.07		2.3	22.9			
82	01/04/2004			4.6	8	2	6	2959/2968	6.19	7.18	5.99	2.4	23.1			
83	01/05/2004	7472	4880	2.4	2	0	2	2966	6.79	7.22	5.68	3.2	22.2	170	23	21.1
84	01/06/2004			4.0	4.6	0.5	4.1	2966	6.83	7.24		3.9	22.0			
85	01/07/2004	7560	4878	4.2	4.6	0	4.6	2966	6.95	7.42	6.51	3.3	21.6			13.1
86	01/08/2004			4.2	4.6	0.5	4.1	2966	7.06	7.42		3.0	22.2			
87	01/09/2004			4.3			0	2966		7.49						

						Chambers Works #7 FBC
		pH controllers				
		INITIAL	FINAL	Bicarb		
DAY	DATE	Bicarb	Bicarb	con-sumed	Waste Vol	
		mL	mL	mL	mL	COMMENTS
62	12/15/2003	210	200	10		same
63	12/16/2003	200	200	0		same, aerator settling more
64	12/17/2003	200	200	0		medium turbidity; no foam
65	12/18/2003	200	200	0		SWITCHED TO LIVE NCH (same loading as before on NCH basis = 4.96mL treated sample / 4.6L Feed) -- BEGAN FEEDING 50% 2959 (NOT adding NH4Cl to new tote)
66	12/19/2003	200	200	0		SWITCHED FEED ENTIRELY TO 2959 -- murky no foam
67	12/20/2003	200	200	0		murky no foam; lowered air and increased feed rate; adjusted pH controller
68	12/21/2003	200	200	0		increased air; turbid with no foam; plug was left in reactor; uncertain how much spilled ; looks ok
69	12/22/2003	200	200	0		slightly turbid; no foam
70	12/23/2003	200	200	0		same as above
71	12/24/2003	200	180	20		slightly turbid
72	12/25/2003			0		
73	12/26/2003	180	175	5		
74	12/27/2003	175	175	0		clear supernate; increased air flow to 200 and increased feed rate to 10; yellow crust on reactor walls
75	12/28/2003	175	175	0		clarifier effluent is turbid - similar to unit # 6
76	12/29/2003	175	170	5		increased controller because pH was too low; decreased air flow; some foam; murky supernate
77	12/30/2003	170	160	10		murky
78	12/31/2003	160	150	10		Very turbid, thin brown/yellow foam
79	01/01/2004	150	150	0		
80	01/02/2004	150	150	0		start 30% drum 2966-1. Murky, thin foam
81	01/03/2004	150	140	10		Same
82	01/04/2004	140	140	0		Very turbid clarifier, similar to #6
83	01/05/2004	140	130	10		Turbid clarifier, deep yellow/orange effluent. Some foam. Crusty yellow build up on walls
84	01/06/2004	130	130	0		Very turbid, thin foam. Much white/yellow crust on walls
85	01/07/2004			0		Some slight turbidity, looks good
86	01/08/2004			0		Bit more turbid than 6, still looks nice. Eff saved for toxicity testing.
87	01/09/2004			0		**End of test 1/8 Rxs sacrificed for cakes and odor panel.**

		Chambers Works #8 NPBI																
		FEED																
DAY	**DATE**	**Feed DOC sol**	**COD tot**	**COD, sol**	**BOD, sol**	**NO2-N**	**NO3-N**	**NH3-N**	**TN, inst**	**TDS**	**SO4**	**PO4-P, Hach**	**Phos-phon-ate-P**	**EMPA-P**	**EMPA**	**MPA**	**MPA-P**	**Total P**
		mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/l**	**mg/L**	**mg/L**	**Calc**		**mg/L**	**mg/L**	**mg/L**
1	10/15/2003																	
2	10/16/2003	372							97									
3	10/17/2003	358		932	589				81			8.1						
4	10/18/2003																	
5	10/19/2003																	
6	10/20/2003	348	1313	1030					76			7.9						
7	10/21/2003	331							111	2960								
8	10/22/2003	333		1156	547				109			6.2	7.3	1.1	4.5			
9	10/23/2003	259							67									
10	10/24/2003	521				<1	<.5	27.9	119		1608	3.8	18.8	13.3	53.2	5	1.74	
11	10/25/2003																	
12	10/26/2003																	
13	10/27/2003	290	1242	1161		<1	<.5		82		1485	5.4	15.8	10.4	41.8	<2.5	0	12.6
14	10/28/2003	221							64	2740								
15	10/29/2003	178		1240	695	<1	<.5		48		1627	2.6	23.4	18.5	73.9	7.06	2.28	
16	10/30/2003	447							94									
17	10/31/2003	344		800		19.25	<.5		73		629	4.0	18.0	12.5	50.1	4.72	1.52	
18	11/01/2003																	
19	11/02/2003																	
20	11/03/2003	244	1724	716		17.18	<.5		55		707	2.4	17.5	13.4	53.8	5.08	1.64	
21	11/04/2003	240							49	3820								
22	11/05/2003	252		894	237				50				21.0	18.6	74.4		2.40	
23	11/06/2003	266				12.52	<.5	16.32	49		633					7.40	2.39	
24	11/07/2003	218							39			4.7	18.4	11.3	45.1		2.40	
25	11/08/2003																	
26	11/09/2003																	
27	11/10/2003	213	714	602		<1	<.5		37		667	2.7	20.5	16.0	64.1	5	1.74	
28	11/11/2003	210							30	3900								
29	11/12/2003	236		635	486				31			4.1	19.5	8.4	33.6		7.00	
30	11/13/2003	**231**				<1	<.5	20	45		950					22	7.05	
31	11/14/2003	202		608					28			4.5	19.8	8.3	33.0		7.00	

		Chambers Works #8 NPBI																			
		EFFLUENT																			
DAY	DATE	Eff 8 DOC	COD tot	Eff 8 COD, sol	Eff 8 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Calc		mg/L	mg/L	mg/L
1	10/15/2003																				
2	10/16/2003	46					78														
3	10/17/2003	38		188	1		51	104	61		<1	11.8	1759	1	1.04				<2.5		
4	10/18/2003																				
5	10/19/2003																				
6	10/20/2003	44	118	96			53	738	460		3.2	35.34	1631.3	2.83	5.4				<2.5		
7	10/21/2003	58					70			3280											
8	10/22/2003	64		124			68	32	17		2.41	23.85	1560.7	2.33					<2.5		
9	10/23/2003	73					60														
10	10/24/2003	66				5.7	60	19	5		2.71	14.06	1584.3	2.24					<2.5		
11	10/25/2003																				
12	10/26/2003																				
13	10/27/2003	88	232	291			65	51	26		1.92	14.69	1619.3	1.76		14.7	11.3	45.1	5.12	1.6533	15.7
14	10/28/2003	54					30			3033											
15	10/29/2003	48		143	11		31	29	9		<1	21.68	1533.5	1.94		9.1	5.9	23.7	3.83	1.2368	
16	10/30/2003	91					45														
17	10/31/2003	132		187			86	39	15		<1	23.18	1596.5	1.58		9.6	6.2	24.9	5.56	1.7954	
18	11/01/2003																				
19	11/02/2003																				
20	11/03/2003	110	328	234			33	141	86		5.25	3.56	805.75			12.8	11.2	44.7	5.06	1.634	
21	11/04/2003	89					38			3960											
22	11/05/2003	81		311	30		36	45	21							13.5	11.7	46.8		1.8	
23	11/06/2003	84				7.88	34				<1	17.3	649.17	1.5					5.61	1.8116	
24	11/07/2003	85					36	40	15							15.4	13.6	54.4		1.8	
25	11/08/2003																				
26	11/09/2003																				
27	11/10/2003	81	216	228			26	50	9		<1	15.87	686.95	3.25		16.6	10.2	40.9	9.67	3.1226	
28	11/11/2003	78					19			3813											
29	11/12/2003	76		249	7		15	39	9							14.7	4.3	17.2		10.4	
30	11/13/2003	73				7.56	15				<1	5.66	719.98	2.4					32.34	10.443	
31	11/14/2003	68		205			14	24	10							16.6	6.2	24.8		10.4	

		Chambers Works #8 NPBI														
		UNIT PERFORMANCE			FEED VOL											
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR
		mg/L	mg/L	L	L	L	L					mg/L		mL/L	mL/g	mg/L/hr
1	10/15/2003								7.43			4.6	22.9			
2	10/16/2003			4.2	4.6	0.5	4.1	2941	7.36	7.95	5.46	0.2	22.4			
3	10/17/2003	10512	6589	4.2	4.6	0.2	4.4	2941	6.96	7.90	5.65	2.5	22.4			35.6
4	10/18/2003			5.9	14.6	8.3	6.3	2941	6.48	7.30	6.00	3.1	20.4			
5	10/19/2003			5.0	8.3	3.1	5.2	2941	6.37	7.10	6.32	3.6	20.5			
6	10/20/2003	11898	7261	1.0	3.1	2	1.1	2941	6.48	6.81	6.04	3.6	20.5			32
7	10/21/2003			2.7	4.6	2	2.6	2941	6.52	7.07	5.94	6.4	20.4			
8	10/22/2003	10437	6586	3.3	4.6	1.2	3.4	2941	6.48	7.22	5.60	4.5	20.2			39.6
9	10/23/2003			4.0	4.6	0.7	3.9	2941	6.45	7.16		3.8	22.4			
10	10/24/2003	13730	8827	3.9	4.6	1	3.6	2941	6.44	7.35	5.71	5.8	23.3			48.9
11	10/25/2003			5.4	14.4	8.2	6.2	2941	6.42			4.6	23.0			
12	10/26/2003			4.8	8.2	3.75	4.45	2941	6.47	7.47	6.12	3.1	22.0			
13	10/27/2003	14309	9421	1.8	3.75	2	1.75	2941	6.42	7.43	6.12	5.0	20.0			57.5
14	10/28/2003			4.0	4.6	1	3.6	2941	6.30	7.27		3.6	22.5			
15	10/29/2003	15385	10035	3.8	4.6	1	3.6	2941	6.40	7.42	6.17	4.9	22.2			58.3
16	10/30/2003			3.5	4.6	1	3.6	2941	6.28	7.14		4.1	22.3			
17	10/31/2003	12905	8539	3.9	4.6	0.8	3.8	**2947-1a**	6.31	7.36	5.85	5.5	22.1			
18	11/01/2003			5.9	13.8	7.5	6.3	2947-1a	6.69	7.00	5.85	6.6	21.9			
19	11/02/2003			5.7	7.5	2.5	5	2947-1a	7.56	7.33	5.85	7.2	21.1			
20	11/03/2003	13346	8754	0.0	2.5	2	0.5	2947-1a	6.37		5.95	5.3	21.4			23.6
21	11/04/2003			3.8	4.6	0.8	3.8	**2947-1b**	6.49	7.19	5.49	5.7	21.1			
22	11/05/2003	11709	7854	4.4	4.6	0.5	4.1	2947-1b	6.75	7.05	5.57	6.3	21.6			23.8
23	11/06/2003			3.4	4.6	1.2	3.4	2947-1b	6.43	7.04	5.92	6.2	21.6			
24	11/07/2003	8568	5623	4.0	4.6	0.8	3.8	**2947-1c 60%**	6.52	7.01		6.5	22.3	210	25	16
25	11/08/2003			5.6	13.8	8.5	5.3	2947-1c 60%	6.33	6.96	5.96	4.5	22.1			
26	11/09/2003			4.6	8.5	4.1	4.4	2947-1c 60%	6.25			4.9	23.6			
27	11/10/2003	12198	7642	2.4	4.1	2	2.1	**2947-1c**	6.30	6.62	5.78	6.6	23.9			11.8
28	11/11/2003			3.5	4.6	1	3.6	**2947-1d 50%**	6.35	6.93		6.0	23.0			
29	11/12/2003	12399	8165	3.8	4.6	0.8	3.8	2947	6.29	7.11	6.25	2.9	21.3	220	18	19
30	11/13/2003			3.9	4.6	0.5	4.1	2947	6.62	7.25	5.37	2.2	20.7			
31	11/14/2003	7600	4956	3.3	4.6	1.2	3.4	2947	6.18	7.19	6.50	2.5	22.0			13.6

DAY	DATE	pH controllers INITIAL Bicarb mL	FINAL Bicarb mL	Bicarb con-sumed mL	Waste Vol mL	Chambers Works #8 NPBI COMMENTS
1	10/15/2003					Start feed CWWW
2	10/16/2003	240	240	0		Looks good, increased DO
3	10/17/2003	240	240	0		Turbid super, looks good
4	10/18/2003	240	240	0		Looks good
5	10/19/2003	240	240	0		pH alarm, pH 6. Some foam in aerator
6	10/20/2003	240	240	0		
7	10/21/2003	240	150	90		1" foam in aerator. Lot of floating solids in clar. Does not look good, DO lowered to 350
8	10/22/2003	150	150	0		lots of floating solids in clar. (less than yesterday) 1/4" scummy foam in aerator
9	10/23/2003	250	250	0		thin scummy foam in aerator, slightly turbid super with floating scum clumps
10	10/24/2003	250	250	0		clear yellow/brown supernate, so more floating solds, 1/2" scummy foam in aerator, BEGAN FEEDING NCH (4.6mL NPBI/4.6mL FEED)
11	10/25/2003	250	250	0		some white foam
12	10/26/2003	250	240	10		1" white foam, slightly turbid supernate
13	10/27/2003	240	230	10		cloudy supernate, some floating sludge, 2 1/2" foam in aerator
14	10/28/2003	230	220	10		supernate slightly turbid, thin foam in aerator, looks ok
15	10/29/2003	220	220	0		1/2" scummy foam, Increased feed rate to "10", not feeding all
16	10/30/2003	220	220	0	500	clear supernate, 1/2" scummy foam, looks ok
17	10/31/2003	220	220	0	500	**FEED SWITCHED 2947** -- bicarb pump ate tubing, Rx pH ok, 1-2" floating sludge in clarifier, supernate slightly turbid, added 1 drop 1/10 AF
18	11/01/2003	220	220	0		1/2" foam, 50% solids in clarifier and turbid, lowered low pH setting
19	11/02/2003	220	210	10		1/2" dense white foam, 50% solids with nearly transparent supernate
20	11/03/2003	210	210	0	100	1" white foam, lowered feed rate, clear supernate, lowered air to "250"
21	11/04/2003	210	210	0		1/2" scumy foam with very clear supernate -- FEED DRUM CHANGED TO 1b
22	11/05/2003	210	200	10		slightly turbid supernate, 1" scummy foam
23	11/06/2003	200	200	0		clear supernate, 1/2" white foam
24	11/07/2003	200	200	0	100	FEED DRUM CHANGED TO 60% 1c, 40% 1b -- supernate almost clear, 1" scummy foam
25	11/08/2003	200	200	0		1" scummy foam, turbid supernate
26	11/09/2003	200	200	0		same
27	11/10/2003	200	200	0		FEED DRUM CHANGED TO 1c -- did not feed enough, feed rate ok (tube misplaced?) 1/2" scummy foam, decreased air from "300" to "200"
28	11/11/2003	200	200	0	100	FEED DRUM CHANGED TO 50% 1d, 50% 1c -- no foam, slight scum caked on walls to 1/4", clear supernate (Rx looks good) decreased air to
29	11/12/2003	200	200	0		no foam, clear supernate
30	11/13/2003	200	200	0	100	slightly turbid, no foa m
31	11/14/2003	200	200	0		feed tube sitting too high, did not feed completely, slightly turbid, no foam

		Chambers Works #8 NPBI																
		FEED																
DAY	DATE	Feed DOC sol	COD tot	COD, sol	BOD, sol	NO2-N	NO3-N	NH3-N	TN, inst	TDS	SO4	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/L	mg/L	Calc		mg/L	mg/L	mg/L
32	11/15/2003																	
33	11/16/2003																	
34	11/17/2003	174		603		<1	1.49		28		656	6.3	21.4	13.3	53.4	5	1.74	
35	11/18/2003	272							58	2227								
36	11/19/2003	283	938	920	488				59			5.2	18.2	11.3	45.4		1.70	
37	11/20/2003	249				0.7	9.65	25	54		752					3	1.04	
38	11/21/2003	280							55			4.4	16.3	11.9	47.4			
39	11/22/2003																	
40	11/23/2003																	
41	11/24/2003	291		874		3.52	7.03		57		917	3.0	17.0	12.3	49.3	5	1.68	
42	11/25/2003	272						26	53	2147								
43	11/26/2003	294	1230	926	488	7.8	1.37		54		926	2.9	21.3	16.3	65.2	7	2.10	
44	11/27/2003																	
45	11/28/2003																	
46	11/29/2003																	
47	11/30/2003																	
48	12/01/2003	264		891		6.91	<.5		49		971					6	1.88	
49	12/02/2003	263							43	2340								
50	12/03/2003	285	896	829	488				44			1.3	23.2	20.0	80.0		1.90	24.5
51	12/04/2003	163				<1	0.65		27		817					<2.5		
52	12/05/2003	170		585				12	16			4.5	16.4	10.0	40.0		1.90	
53	12/06/2003																	
54	12/07/2003																	
55	12/08/2003	167		578		<1	1.17		12		671	4.7	18.2	11.3	45.0	7	2.29	
56	12/09/2003	163							12	1733								
57	12/10/2003	158	569	566	148				12			6.7	18.5	9.9	39.6		1.90	19.3
58	12/11/2003	143				<1	<.5	21	25		626					6	1.91	
59	12/12/2003	157		481					24			4.9	18.0	11.2	44.6		1.90	
60	12/13/2003	157																
61	12/14/2003	157																

		Chambers Works #8 NPBI																			
		EFFLUENT																			
DAY	DATE	Eff 8 DOC	COD tot	Eff 8 COD, sol	Eff 8 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Calc		mg/L	mg/L	mg/L
32	11/15/2003																				
33	11/16/2003																				
34	11/17/2003	56		278			14	34	12		<1	9.07	705.83	2.71		14.9	1.9	7.6	31.87	10.291	
35	11/18/2003	60					14			4307											
36	11/19/2003	66	214	232	14		19	25	6							15.5	4.5	18.0		11	
37	11/20/2003	68				14.07	20				<1	3.27	847.07	2.56					34.39	11.105	
38	11/21/2003	100					33	42	24							14.8	3.8	15.2		11	
39	11/22/2003																				
40	11/23/2003																				
41	11/24/2003	92		262			33	13	9		<1	6.78	969.28	1.55		13.6	2.5	10.1	29.46	9.5131	
42	11/25/2003	95				22.71	37			2107											
43	11/26/2003	106	321	294	66		39	35	18		1.38	2.94	962.65	1.43		16	5.4	21.6	28.41	9.1741	
44	11/27/2003																				
45	11/28/2003																				
46	11/29/2003																				
47	11/30/2003																				
48	12/01/2003	100		282			39	43	20		<1	<.5	979.65	1.19					27.27	8.8059	
49	12/02/2003	102					38			2507											
50	12/03/2003	109	378	268	52		38	61	35							14.8	6.0	24.0		8.8	16.0
51	12/04/2003	113					41				<1	<.5	1027.4	0.92					26.8	8.6542	
52	12/05/2003	107		327		26.49	41	91	54							13.4	4.7	18.8		8.7	
53	12/06/2003																				
54	12/07/2003																				
55	12/08/2003	83		249		20.93	27	197	128		<1	<.5	975.65	0.74		15.4	3.9	15.5	33.42	10.792	
56	12/09/2003	76					22			1653											
57	12/10/2003	68	236	185	20		7									14.9	6.1	24.4		8.8	15.9
58	12/11/2003	69				10.86	8				<1	<.5	665.42	1.77					27.31	8.8189	
59	12/12/2003	67		158			10									16.6	7.8	31.2		8.8	
60	12/13/2003	70					14														
61	12/14/2003	67					24														

		Chambers Works #8 NPBI														
		UNIT PERFORMANCE			FEED VOL											
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR
		mg/L	mg/L	L	L	L	L					mg/L		mL/L	mL/g	mg/L/hr
32	11/15/2003			4.0	13.8	10	3.8	2947	6.44	7.16	5.85	1.4	21.8			
33	11/16/2003			6.0	10	3.9	6.1	2947	6.36	7.08	5.93	0.7	21.6			
34	11/17/2003	11535	7596	3.6	3.9	0	3.9	2947	6.42	7.25	6.56	2.0	20.9			16
35	11/18/2003			3.8	4.6	0.8	3.8	**2951**	6.41	7.20	5.58	0.3	21.3			
36	11/19/2003	9053	5931	4.2	4.6	0.5	4.1	2951	6.63	7.27	5.38	1.0	21.2	215	24	20.5
37	11/20/2003			3.2	4.6	1.5	3.1	2951	6.81	7.29	6.12	3.6	20.9			
38	11/21/2003	9445	6243	4.3	4.6	0.8	3.8	2951	6.97	7.06	5.44	4.1	21.7			15.2
39	11/22/2003			4.6	13.8		13.8	2951								
40	11/23/2003			4.2	9.5	5.1	4.4	2951	6.52			3.1	23.0			
41	11/24/2003	6780	4528	2.9	5.1	1	4.1	2951	6.96	7.05	5.55	5.1	236.4			22.8
42	11/25/2003			3.0	4.6	1.2	3.4	2951	7.00	7.08	5.46	5.1	22.6			
43	11/26/2003	5150	3416	3.5	4.6	0.8	3.8	2951	6.70	7.00	5.82	4.3	21.1	210	41	22.7
44	11/27/2003				18.4	13	5.4	2951								
45	11/28/2003				13	8	5	2951								
46	11/29/2003			3.9	8	4.2	3.8	2951								
47	11/30/2003			3.4	4.2	1	3.2	2951	7.31			5.4	21.5			
48	12/01/2003	10393	7053	3.6	4.6	1	3.6	2951	6.91	7.33	5.72	4.9	20.9			16.8
49	12/02/2003			3.5	4.6	0.2	4.4	2951-5	7.04	7.28	5.71	4.4	20.6			
50	12/03/2003	10317	6860	3.8	4.6	0.7	3.9	2951-5	6.73	7.37	6.28	4.2	22.9	240	23	14.2
51	12/04/2003			3.8	4.6	0.5	4.1	37% 2954	6.91	7.16		5.8	21.5			
52	12/05/2003	10778	7198	3.0	4.6	1	3.6	100% 2954	6.72	7.26	5.59	2.9	21.3			20.4
53	12/06/2003			4.9	13.8		13.8	2954	6.60							
54	12/07/2003			3.5		5.8	-5.8	2954	6.97	7.16	5.90	7.2	21.7			
55	12/08/2003	13327	8903	0.0	5.8	1	4.8	2954	6.92	N/A		4.7	21.5			18.6
56	12/09/2003			3.6	4.6	0.6	4	2954	6.61	7.33	5.58	1.4	21.9			
57	12/10/2003	11920	8006	4.0	4.6	0.3	4.3	2954	6.57	7.26	5.53	5.3	21.3			11.8
58	12/11/2003			4.0	4.6	0.5	4.1	2954	6.50	7.16	6.17	3.4	21.4			
59	12/12/2003	11164	7546	4.2	4.6	0.2	4.4	2954	6.69	7.07	6.02	4.6	21.2			10.7
60	12/13/2003			3.9	13.8	9.4	7.1	2954	6.74			5.1	21.3			
61	12/14/2003			2.0	7.1	2	5.1	2954	6.83			7.1	21.6			

						Chambers Works #8 NPBI
		pH controllers				
		INITIAL	FINAL	Bicarb		
DAY	DATE	Bicarb	Bicarb	con-sumed	Waste Vol	
		mL	mL	mL	mL	COMMENTS
32	11/15/2003	200	200	0		slightly turbid, no foam
33	11/16/2003	200	200	0	50	same, increased air "70" to "100", slightly increased low pH setting
34	11/17/2003	200	200	0		same
35	11/18/2003	200	200	0		same -- Switched feed to 2951
36	11/19/2003	200	200	0	50	turbid clarifier, o foam
37	11/20/2003	200	175	25		same
38	11/21/2003	175	175	0	50	slightly less turbid, no foam
39	11/22/2003	175	175	0		slightly turbid, no foam
40	11/23/2003	175	175	0		same
41	11/24/2003	175	175	0		nearly clear, no foam
42	11/25/2003	175	175	0		slightly turbid, no foam
43	11/26/2003	190	190	0		same
44	11/27/2003	190	190	0		same
45	11/28/2003	190	190	0		same
46	11/29/2003	190	190	0		same
47	11/30/2003	190	190	0		same
48	12/01/2003	190	190	0		slightly turbid, thin foam
49	12/02/2003	190	190	0		turbid, no foam -- BEGAN FEEDING DRUM 5 FROM 2951
50	12/03/2003	190	190	0		slightly turbid, no foam
51	12/04/2003	190	190	0		SWITCHED FEED TO 37% 2954 -- same, feed tubing was plugged
52	12/05/2003	190	175	15		SWITCHED FEED ENTIRELY TO 2954 -- same
53	12/06/2003	175	175	0		same
54	12/07/2003	175	175	0		same, decreased air "80" to "40"
55	12/08/2003	175	175	0		same, did not feed last night pump malfunctioning
56	12/09/2003	175	170	5		slightly turbid, no foam, increased air
57	12/10/2003	190	190	0		slightly turbid, no foam
58	12/11/2003	190	190	0		BEGAN ADDING 10 mg/L NH4Cl-N TO FEED FOR ALL REACTORS -- same, increased feed rate to "9"
59	12/12/2003	190	190	0		turbid, no foam
60	12/13/2003	190	180	10		less turbid, no foam
61	12/14/2003	180	180	0		feed pump not running changed pump - strong odor - high DO but air flow very low - clear supernate no foam

		Chambers Works #8 NPBI																
		FEED																
DAY	DATE	Feed DOC sol	COD tot	COD, sol	BOD, sol	NO2-N	NO3-N	NH3-N	TN, inst	TDS	SO4	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/L	mg/L	Calc		mg/L	mg/L	mg/L
62	12/15/2003	154		460		<1	<.5		23		643	6.3	18.9	10.5	41.9	7	2.13	
63	12/16/2003	139							25	1867								
64	12/17/2003	154	450	334	250				25			5.2	17.9	10.6	42.4		2.10	18.3
65	12/18/2003	153				<1	7.17	26	40		1346					<2.5		
66	12/19/2003	231		759					60			0.0	17.0	17.0	67.9			
67	12/20/2003																	
68	12/21/2003																	
69	12/22/2003	216	859	746		<1	14.38		58		1968	0.3	10.7	10.4	41.4	<2.5		
70	12/23/2003	231							61	5693								
71	12/24/2003																	
72	12/25/2003																	
73	12/26/2003	231			462	<1	14.59				2000					<2.5		
74	12/27/2003																	
75	12/28/2003																	
76	12/29/2003	218		777		<1	14.38		60		1949	0.8	13.7	12.9	51.6	<2.5		13.3
77	12/30/2003	188						31	47	5720								
78	12/31/2003	237	795	630	438				65			0.3	11.2	10.9	43.5			
79	01/01/2004																	
80	01/02/2004	224		579		<1	14.18		61		1928		10.3	10.3	41.2	<2.5		
81	01/03/2004																	
82	01/04/2004																	
83	01/05/2004	304		1090		<1	<.5		56		2444	5.8	11.6	4.6	18.5	4	1.21	
84	01/06/2004	290							58	8227								
85	01/07/2004	289	1158	1071	489				56			2.5	15.9					
86	01/08/2004	289																
87	01/09/2004																	

		Chambers Works #8 NPBI																			
		EFFLUENT																			
DAY	DATE	Eff 8 DOC	COD tot	Eff 8 COD, sol	Eff 8 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Calc		mg/L	mg/L	mg/L
62	12/15/2003	64		198			16				<1	<.5	726.36	2.57		18.6	5.4	21.5	32.96	10.643	
63	12/16/2003	62					16			1833											
64	12/17/2003	62	185	92	31		12	30	10							13.9	3.3	13.2		10.6	16.5
65	12/18/2003					15.22					<1	<.5	651.37	2.4					31.48	10.165	
66	12/19/2003	57		156			22	30	9							24.5	24.5	98.0			
67	12/20/2003																				
68	12/21/2003																				
69	12/22/2003	64	197	242			34	28	6		<1	<.5	1964	0.9		9.6	5.1	20.3	11.22	3.6231	
70	12/23/2003	70					36														
71	12/24/2003																				
72	12/25/2003																				
73	12/26/2003	73		229	39		36	39	6		<1	<.5	2076.3	0.9		9.5	4.9	19.6	11.44	3.6942	
74	12/27/2003																				
75	12/28/2003																				
76	12/29/2003	62		219			42	29	5		<1	4.54	2049.8	0.9		12.6	7.7	30.7	12.47	4.0268	10.8
77	12/30/2003	63				27.1	42			5493											
78	12/31/2003	65	213	203	18		37	151	96							10.2	10.2	40.8			
79	01/01/2004																				
80	01/02/2004	70		124			38	25	2		<1	0.79	2013.9	0.9		10.3	3.8	15.2	17.37	5.6091	
81	01/03/2004	69					40														
82	01/04/2004	74					40														
83	01/05/2004	78		258			40	16	3		<1	<.5	2187.4	0.9		11.6	1.9	7.5	27.33	8.8253	
84	01/06/2004	89					47			6853											
85	01/07/2004	86	348	280	23	32.69	44	44	22							12	12.0	48.0			
86	01/08/2004	83					49				<1	<.5	2761.4	<1					27.39		
87	01/09/2004																				

		Chambers Works #8 NPBI														
		UNIT PERFORMANCE			FEED VOL											
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR
		mg/L	mg/L	L	L	L	L					mg/L		mL/L	mL/g	mg/L/hr
62	12/15/2003	12936	8809	4.0	4.6	0	4.6	2954	6.55	7.08	5.61	0.8	21.4			12.2
63	12/16/2003			4.7	4.6		4.6	2954	6.68	7.00	5.38	5.2	21.4			
64	12/17/2003	12539	8597	3.7	4.6	0.8	3.8	2954	6.54	7.06	5.24	5.7	21.2	260	21	16.9
65	12/18/2003			4.3	4.6	0	4.6	50% 2959	6.39	7.01	5.96	1.8	20.7			
66	12/19/2003	12205	8291	3.2	4.6	0	4.6	2959	6.41	7.04	5.40	3.2	21.1			12
67	12/20/2003			4.2	13.8	9.7	4.1	2959	6.32			2.3	22.5			
68	12/21/2003			5.1	9.7	3.9	5.8	2959	6.47			1.1	21.7			
69	12/22/2003	13437	9082	3.5	3.9	0	3.9	2959	6.29	6.78	5.24	2.5	21.4			35
70	12/23/2003			4.3	4.6	0.2	4.4	2959	6.55	6.93	5.19	1.5	21.8			
71	12/24/2003			6.0	13.8	8.2	5.6	2959								
72	12/25/2003						0	2959								
73	12/26/2003	11162	7552	7.4		0.3	-0.3	2959	5.49	6.71	5.49	2.7	22.5			24.7
74	12/27/2003			4.5	13.8	8.5	5.3	2959		7.04		5.7	22.2			
75	12/28/2003			5.5	8.5	2.9	5.6	2959	5.98	6.92	5.98	5.4	22.5			
76	12/29/2003	12868	8704	2.4	2.9	0	2.9	2959	5.09	6.75	5.09	5.9	21.9	340	26	15.2
77	12/30/2003			4.4	4.6	0	4.6	2959	5.02	7.25	5.02	3.6	22.2			
78	12/31/2003	12810	8710	4.0	4.6	0.2	4.4	2959	6.62	7.15	5.21	5.1	22.3			13.6
79	01/01/2004				9.2	5	4.2	2959								
80	01/02/2004	13233	8473	9.0	5	1	4	2959/2966	6.68	7.01	5.15	1.3	22.7			12.7
81	01/03/2004			5.3	13.8	7.5	6.3	2959/2967	6.82	7.28		3.1	23.0			
82	01/04/2004			4.8	7.5	2	5.5	2959/2968	6.53	7.27	6.33	4.6	23.3			
83	01/05/2004	13761	8661	1.4	2	0	2	2966	6.99	7.23	5.86	5.1	22.1	360	26	12.2
84	01/06/2004			3.5	4.6	0	4.6	2966	6.75	7.16		1.5	22.3			25.3
85	01/07/2004	14039	8391	4.3	4.6	0	4.6	2966	7.03	7.42	6.86	4.5	21.6			16.2
86	01/08/2004			4.3	4.6	0.7	3.9	2966	7.44	7.42		7.0	22.1			
87	01/09/2004			3.9				2966		7.31						

						Chambers Works #8 NPBI
		pH controllers				
		INITIAL	FINAL	Bicarb		
DAY	DATE	Bicarb	Bicarb	con-sumed	Waste Vol	
		mL	mL	mL	mL	COMMENTS
62	12/15/2003	180	180	0		no strong odor today - slightly turbid, no foam, increased air "50" to "60"
63	12/16/2003	180	180	0		slightly turbid, no foam, aerator not mixing well
64	12/17/2003	180	180	0		slight turbidity with no foam; decreased air from 50 to 40
65	12/18/2003	180	180	0		SWITCHED TO LIVE NCH (same loading as before on NCH basis = 3.18mL treated sample /4.6L Feed) -- SWITCHED TO 50% 2959 (NOT adding NH4Cl to new tote) - same as above
66	12/19/2003	180	180	0		SWITCHED FEED ENTIRELY TO 2959 -- almost clear effluent; very yellow with no foam
67	12/20/2003	180	180	0		crystal clear but supernate is yellow; adjusted pH controller
68	12/21/2003			0		same as above
69	12/22/2003	180	175	5		slight turbidity with very yellow supernate and no foam
70	12/23/2003	175	175	0		clearer; very dark yellow with no foam
71	12/24/2003	175	170	5		almost clear; very dark yellow
72	12/25/2003			0		
73	12/26/2003	170	170	0		increased air
74	12/27/2003	170	170	0		decreased air to 100
75	12/28/2003	170	160	10		50 % settleable solids in clarifier; effluent is much less turbid than unit # 7
76	12/29/2003	160	150	10		lowered air
77	12/30/2003	150	150	0		slightly turbid; supernate is very yellow
78	12/31/2003	150	150	0		Nearly clear, 50% settled. Very yellow, no foam. Rx smell bad, not quite a NCH smell
79	01/01/2004	150	140	10		
80	01/02/2004	140	135	5		start 30% drum 2966-1, bit less murky than 7, yellowish
81	01/03/2004	135	135	0		Slightly turbid, yellow
82	01/04/2004	135	120	15		60% settled solids. Supernate much less turbid than 6 or 7
83	01/05/2004	120	115	5		start 100% drum 2966-1Extremely murky yellow/orange supernate. Some turbidity, more murkiness. Some foam. Yellow crusty buiold up on walls. Sludge is slimey, clings to everything.
84	01/06/2004	115	115	0		Inadvertantly added Rx 1 300mL to this reactor. Murky, yellow orange, yellow crusty buildup on walls
85	01/07/2004					Turbid, some foam
86	01/08/2004					Murky yellow, not nice. Eff saved for toxicity testing
87	01/09/2004					**End of test 1/8 Rxs sacrificed for cakes and odor panel.**

		Chambers Works #9 NP4XC																
		FEED																
DAY	DATE	Feed DOC sol	COD tot	COD, sol	BOD, sol	NO2-N	NO3-N	NH3-N	TN, inst	TDS	SO4	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
1	10/15/2003																	
2	10/16/2003	372							97									
3	10/17/2003	358		932	589				81			8.1						
4	10/18/2003																	
5	10/19/2003																	
6	10/20/2003	348	1313	1030					76			7.9						
7	10/21/2003	331							111	2893								
8	10/22/2003	333		1156	547				109			6.2	7.3	1.1	4.5			
9	10/23/2003	259							67									
10	10/24/2003	569				<1	<.5	18.3	118		1719	3.7	32.0	23.4	93.6	15	4.86	
11	10/25/2003																	
12	10/26/2003																	
13	10/27/2003	447	1743	1643		<1	<.5	36.67	110		1737	3.0	52.5	42.6	170.4	21.33	6.89	57.5
14	10/28/2003	388							94	3327								
15	10/29/2003	391		1616	599	<1	<.5		92		1734	4.4	55.2	44.4	177.4	19.97	6.45	
16	10/30/2003	566							104									
17	10/31/2003	446		1165		19.34	<.5		88		810	3.6	51.6	40.7	162.6	22.67	7.32	
18	11/01/2003																	
19	11/02/2003																	
20	11/03/2003	407	1220	1070		18.83	<.5		73		776	3.3	56.7	45.5	182.1	24.27	7.84	
21	11/04/2003	389							67	4440								
22	11/05/2003	386		1139	290				66				63.2	54.8	219.2		8.40	
23	11/06/2003	410				11.76	<.5	25.27	65		815					26.03	8.41	
24	11/07/2003	368							58			3.9	52.1	39.8	159.3		8.40	
25	11/08/2003																	
26	11/09/2003																	
27	11/10/2003	373	987	1126		<1	<.5		57		873	2.4	65.2	54.4	217.6	26	8.36	
28	11/11/2003	360							50	4340								
29	11/12/2003	365		936	570				47			3.2	51.0	42.6	170.4		5.20	
30	11/13/2003	269				<1	<.5	17	38		843					16	5.24	
31	11/14/2003	357		917					52			5.4	65.2	54.7	218.6		5.20	

		Chambers Works #9 NP4XC																			
		EFFLUENT																			
DAY	DATE	Eff 9 DOC	COD tot	Eff 9 COD, sol	Eff 9 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
1	10/15/2003																				
2	10/16/2003	49					82														
3	10/17/2003	42		132	1		65	26	14		<1	19.8	1958	3.63	3.56				<2.5		
4	10/18/2003																				
5	10/19/2003																				
6	10/20/2003	48	133	126			56	80	43		<1	<.5	1798	5.1	3.38				<2.5		
7	10/21/2003	57					75			2993											
8	10/22/2003	67		136			71	20	8		<1	1.95	1714	5.01					<2.5		
9	10/23/2003	76					66														
10	10/24/2003	80				34.4	66	17	6		1.15	10.4	1714	3.82					3.51	1.1	
11	10/25/2003																				
12	10/26/2003																				
13	10/27/2003	168	793	695			77	56	36		<1	30.66	1815	3.46		47.4	36.8	147.1	22.2	7.2	48.9
14	10/28/2003	173					84			3220											
15	10/29/2003	173		513	65		86	115	67		<1	18.37	1770	3.76		49.3	37.6	150.4	24.6	7.9	
16	10/30/2003	230					83														
17	10/31/2003	227		485			89	72	44		<1	10	1818	4.3		49	32.3	129.1	38.5	12.4	
18	11/01/2003																				
19	11/02/2003																				
20	11/03/2003	190	338	447			54	69	43		<1	17.66	970	3.64		47.9	8.2	32.7	111.7	36.1	
21	11/04/2003	202					56			4433											
22	11/05/2003	194		476	8		53	78	47							48.4	11.1	44.4		37.3	
23	11/06/2003	197				19.3	51				<1	17.26	845	3.01					115.4	37.3	
24	11/07/2003	208					56	47	18							50.8	13.5	54.0		37.3	
25	11/08/2003																				
26	11/09/2003																				
27	11/10/2003	205	448	354			58	46	5		<1	7.48	918	3.55		62.6	20.3	81.3	119.9	38.7	
28	11/11/2003	205					51			4447											
29	11/12/2003	195		528	11		47	46	15					2.7		50	3.5	14.0		43.8	
30	11/13/2003	196				27	44				<1	<.5	908	2.65					135.6	43.8	
31	11/14/2003	212		592			43	33	14					2.7		65.2	18.7	74.8		43.8	

		Chambers Works #9 NP4XC																	
		UNIT PERFORMANCE			FEED VOL												pH controllers		
																	INITIAL	FINAL	1.0N
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR	1.0N H2SO4	1.0N H2SO4	H2SO4 con-sumed
		mg/L	mg/L	L	L	L	L					mg/L		mL/L	mL/g	mg/L/hr	mL	mL	mL
1	10/15/2003								**6.47**			**5.6**	23.2						
2	10/16/2003			3.8	4.6	0	4.6	2941	6.61	7.22	5.46	7.2	21.9				200	150	50
3	10/17/2003	13674	8742	4.5	4.6	0	4.6	2941	6.49	7.27	5.65	1.5	23.0			40.2	150	150	0
4	10/18/2003			6.8	14.6	7.2	7.4	2941	6.59	7.17	5.99	1.9	17.4				150	150	0
5	10/19/2003			6.1	7.2	1	6.2	2941	6.56	7.10	6.48	0.6	19.4				150	150	0
6	10/20/2003	13162	8363	0.9	1	0	1	2941	6.40	7.14	6.04	1.8	20.0			37.7	150	125	25
7	10/21/2003			4.4	4.6	0.1	4.5	2941	6.59	7.09	6.01	0.6	20.6				250	250	0
8	10/22/2003	14016	9249	4.4	4.6	0	4.6	2941	6.44	7.20	5.60	1.1	20.5			29	250	210	40
9	10/23/2003			4.4	4.6	0	4.6	2941	6.47	7.11		1.3	22.4				210	200	10
10	10/24/2003	15320	10127	4.5	4.6	0	4.6	2941	6.21	7.25	5.52	4.9	23.6			48	200	200	0
11	10/25/2003			5.2	14.1	8.8	5.3	2941	6.49			4.0	22.9				200	200	0
12	10/26/2003			4.5	8.8	4	4.8	2941	6.49	6.99	6.32	5.2	21.2				200	200	0
13	10/27/2003	14053	9460	4.0	4	0	4	2941	6.49	3.84	6.02	6.5	21.1			38.7	200	200	0
14	10/28/2003			4.5	4.6	0	4.6	2941	6.65	6.92		5.5	22.2				200	200	0
15	10/29/2003	14816	10009	4.6	4.6	0.2	4.4	2941	6.58	6.97	5.27	5.9	22.1			35.5	200	200	0
16	10/30/2003			4.0	4.6	0	4.6	2941	6.57	6.97	5.26	5.8	22.4				200	200	0
17	10/31/2003	14047	9588	4.3	4.6	0	4.6	**2947-1a**	6.53	6.94	5.54	5.3	22.7			19.1	200	190	10
18	11/01/2003			5.3	14	7.5	6.5	2947-1a	6.60	6.80	5.54	6.2	22.0				190	190	0
19	11/02/2003			5.0	7.5	3.5	4	2947-1a	6.54	6.76	5.54	7.0	21.1				190	180	10
20	11/03/2003	10123	6975	2.9	3.5	0	3.5	2947-1a	6.52	6.70	5.73	6.4	21.8			16.3	180	150	30
21	11/04/2003			4.1	4.6	0	4.6	**2947-1b**	6.55	6.69	5.38	5.0	21.7				150	150	0
22	11/05/2003	9854	6881	4.4	4.6	0	4.6	2947-1b	6.50	6.78	5.40	5.8	21.6	180		31	150	150	0
23	11/06/2003			4.4	4.6	0	4.6	2947-1b	6.49	6.84	5.70	6.0	21.1				150	150	0
24	11/07/2003	10912	7564	4.5	4.6	0	4.6	**2947-1c 60%**	6.55	6.87		4.2	21.4		0	16	150	150	0
25	11/08/2003			4.9	14	7.5	6.5	2947-1c 60%	6.61	7.00	5.80	3.3	21.2				150	150	0
26	11/09/2003			4.7	7.5	4	3.5	2947-1c 60%	6.64	7.17		3.3	23.8				150	150	0
27	11/10/2003	9659	6471	4.0	4	0	4	**2947-1c**	6.51	6.91	5.75	3.4	23.2			19.1	150	150	0
28	11/11/2003			4.1	4.6	0	4.6	**2947-1d 50%**	6.66	6.92		4.3	23.3				150	150	0
29	11/12/2003	9346	6356	4.2	4.6	0	4.6	2947	6.68	7.06	6.20	4.0	21.3	160	17	34.2	off	off	off
30	11/13/2003			4.1	4.6	0	4.6	2947	6.74	7.07	5.47	3.1	20.9						0
31	11/14/2003	6398	4212	4.2	4.6	0	4.6	2947	6.59	7.01	5.98	3.8	21.5			26.1			0

						Chambers Works #9 NP4XC
		pH controllers				
		INITIAL	FINAL	Bicarb		
DAY	DATE	Bicarb	Bicarb	con-sumed	Waste Vol	
		mL	mL	mL	mL	COMMENTS
1	10/15/2003					start feeding CWww
2	10/16/2003	240	230	10		looks good
3	10/17/2003	230	230	0		clear supernate, well settled
4	10/18/2003	230	230	0		lowered feed rate. Looks good
5	10/19/2003	230	230	0		lowered feed rate, good
6	10/20/2003	230	230	0		looks good
7	10/21/2003	230	230	0		supernate very dark color, but almost clear, well settled. Rx looks great
8	10/22/2003	230	230	0		Increased air to "25", fairly clear effluent, little foam
9	10/23/2003	230	225	5		Rx looks good, supernate clear, thin foam in aerator
10	10/24/2003	225	225	0		aerator loooks good, clarifier turbid with floating solids, BEGAN FEEDING NCH (18mL NP4X/4.6mL FEED)
11	10/25/2003	225	200	25		some white foam
12	10/26/2003	200	200	0		turbid supernate, 1" dark foam in aerator, added 1 drop 1/10 antifoam
13	10/27/2003	200	200	0		turbid, 1" scummy foam
14	10/28/2003	200	200	0		turbid, 1/2" scummy foam
15	10/29/2003	200	200	0		1 1/2" scummy foam, thick blanket of floating solids on top of turbid supernate, added AF
16	10/30/2003	200	200	0	500	1" foam, supernate slightly turbid, but much better than Rx 10 and Rx C, small amount of floating solids in clarifier, added
17	10/31/2003	200	200	0	500	1" scummy foam, 1/4" blanket of floating solids on top of turbid supernate -- **Switched feed to 2947**
18	11/01/2003	200	200	0		1" foam, clarifier turbid, 2 drops 1/10 AF
19	11/02/2003	200	200	0		1 1/2" scummy foam, small amount of floating solids on turbid carifier
20	11/03/2003	200	200	0		very dark clarifier, floating sludge, 1-2" scummy foam on aerator, lowered air to "20"
21	11/04/2003	200	200	0	100	less floating in clarifier, slimy black foam in aerator -- FEED DRUM CHANGED TO 1b
22	11/05/2003	200	200	0		Rx looks good, semi clear supernate, very slight scummy foam
23	11/06/2003	200	200	0		same
24	11/07/2003	200	200	0	100	FEED DRUM CHANGED TO 60% 1c, 40% 1b -- turbid supernate, thin foam in aerator
25	11/08/2003	200	200	0		slight foaming, turbid clarifier, 2 drops 1/10 AF
26	11/09/2003	200	200	0		scummy aerator
27	11/10/2003	200	200	0	100	FEED DRUM CHANGED TO 1c -- nearly clear supernate with some floating solids, 1/2" scummy foam
28	11/11/2003	200	200	0		FEED DRUM CHANGED TO 50% 1d, 50% 1c -- thick, black foam, fairly clear supernate
29	11/12/2003	200	200	0	100	1/2" very dense scummy foam, slightly turbid supernate
30	11/13/2003	200	200	0		1/2" very scummy foam, clear supernate
31	11/14/2003	200	200	0	100	same

		Chambers Works #9 NP4XC																
		FEED																
DAY	DATE	Feed DOC sol	COD tot	COD, sol	BOD, sol	NO2-N	NO3-N	NH3-N	TN, inst	TDS	SO4	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
32	11/15/2003																	
33	11/16/2003																	
34	11/17/2003	318		831		<1	1.46		48		855	3.9	62.0	49.6	198.3	27	8.59	
35	11/18/2003	405							76	2333								
36	11/19/2003	421	1283	1262	559				76			3.5	51.9	39.9	159.7		8.50	
37	11/20/2003	396				<1	9.66	35	73		945					20	6.48	
38	11/21/2003	424							74			3.2	51.5	41.8	167.2		6.50	
39	11/22/2003																	
40	11/23/2003																	
41	11/24/2003	428		1203		3.44	7.01		74		1095		47.8	40.4	161.7	23	7.38	
42	11/25/2003	434						34	75	2493								
43	11/26/2003	475	1486	1306	559	7.77	1.4		79		1159	2.7	68.0	55.0	220.2	32	10.24	
44	11/27/2003																	
45	11/28/2003																	
46	11/29/2003																	
47	11/30/2003																	
48	12/01/2003	470		1292		6.83	<.5		74		1161					31	10.13	
49	12/02/2003	408							59	2787								
50	12/03/2003	393	1195	1012	559				57			1.4	51.0	39.5	157.9		10.10	55.0
51	12/04/2003	211				<1	0.67		33		852					4		
52	12/05/2003	298		885				20	33			4.4	48.0	43.6	174.5			
53	12/06/2003																	
54	12/07/2003																	
55	12/08/2003	314		897		<1	1.13		32		834	3.4	47.0	35.1	140.3	26	8.48	
56	12/09/2003	306							31	2033								
57	12/10/2003	290	937	887	210				30			4.7	50.0	37.5	150.1		7.80	55.0
58	12/11/2003	299				<1	<.5	30	47		792					24	7.76	
59	12/12/2003	294		793					42			3.6	52.0	40.6	162.5		7.80	
60	12/13/2003	294																
61	12/14/2003	294																

		Chambers Works #9 NP4XC																			
		EFFLUENT																			
DAY	DATE	Eff 9 DOC	COD tot	Eff 9 COD, sol	Eff 9 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
32	11/15/2003																				
33	11/16/2003																				
34	11/17/2003	155		493			36	44	16		<1	3.06	882	2.89		46.9	3.1	12.4	126.7	40.9	
35	11/18/2003	165					35			4520											
36	11/19/2003	172	446	530	10		43	34	15							47.4	6.4	25.6		41.0	
37	11/20/2003	172				28.9	45				<1	4.63	1064	2.58					137.1	44.3	
38	11/21/2003	184					52	99	59							50	6.0	24.0		44.0	
39	11/22/2003																				
40	11/23/2003																				
41	11/24/2003	181		506			53	6	4		<1	6.67	1219	1.3		51.4	4.6	18.4	140.9	45.5	
42	11/25/2003	195				34.6	53			2627											
43	11/26/2003	203	572	470	5		54	176	112		<1	1.47	1216	1.67		52.7	2.5	9.9	150.3	48.5	
44	11/27/2003																				
45	11/28/2003																				
46	11/29/2003																				
47	11/30/2003																				
48	12/01/2003	170		442			51	20	10		<1	<.5	1165	1.53					114.3	36.9	
49	12/02/2003	176					47			2893											
50	12/03/2003	183	423	475	17		47	18	8					1.5		47	8.6	34.4		36.9	51.0
51	12/04/2003	191					54				<1	<.5	1227	1					136.1	44.0	
52	12/05/2003	182		446		34.2	52	18	4							47	3.0	12.0		44.0	
53	12/06/2003																				
54	12/07/2003																				
55	12/08/2003	172		431		25.7	34	19	0		<1	0.75	980	1.99		48	-1.4	-5.8	147.0	47.5	
56	12/09/2003	171					34			2200											
57	12/10/2003	168	446	403	4		32									52	4.5	18.0		47.5	53.0
58	12/11/2003	175				27.9	38				<1	<.5	870	2.98					145.4	47.0	
59	12/12/2003	177		382			38									55	8.0	32.0		47.0	
60	12/13/2003	181					46														
61	12/14/2003	168					45														

		Chambers Works #9 NP4XC																	
		UNIT PERFORMANCE			FEED VOL														
																	pH controllers		
																	INITIAL	FINAL	1.0N
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR	1.0N H2SO4	1.0N H2SO4	H2SO4 con-sumed
		mg/L	mg/L	L	L	L	L					mg/L		mL/L	mL/g	mg/L/hr	mL	mL	mL
32	11/15/2003			3.9	13.8	10	3.8	2947	6.43	6.96	5.78	2.6	21.1						0
33	11/16/2003			5.5	10	4	6	2947	6.34	6.79	5.88	2.4	21.2						0
34	11/17/2003	10291	4020	3.4	4	0.3	3.7	2947	6.82	7.25	5.86	2.9	20.8			17.3			0
35	11/18/2003			4.3	4.6	0	4.6	2951	6.84	7.33	5.19	1.4	21.6						0
36	11/19/2003	7240	4903	4.0	4.6	0.5	4.1	2951	6.71	7.18	5.13	2.3	20.9	170	23	16.1			0
37	11/20/2003			4.2	4.6	0	4.6	2951	6.93	7.20	5.57	4.7	20.7						
38	11/21/2003	6860	4648	4.3	4.6	0	4.6	2951	6.80	7.13	5.39	2.3	21.3			15.9			
39	11/22/2003			4.1	13.8		13.8	2951											
40	11/23/2003			3.8	10	6	4	2951	6.73			2.1	22.1						
41	11/24/2003	7733	5319	4.0	6	1.5	4.5	2951	6.81	7.36		2.7	23.3			35.9			
42	11/25/2003			3.6	4.6	0	4.6	2951	6.68	7.19	5.84	1.5	22.3						
43	11/26/2003	7372	5044	2.0	4.6	2.7	1.9	2951	6.87	7.20	5.61	3.6	21.2	180	24	22.4			
44	11/27/2003				18.4		18.4	2951											
45	11/28/2003						0	2951											
46	11/29/2003			3.8		4.9	-4.9	2951	6.68			2.3	21.0						
47	11/30/2003			3.8	4.9	0	4.9	2951	7.19			4.2	21.0						
48	12/01/2003	11004	7770	4.2	4.6		4.6	2951	6.77	7.30	5.37	1.1	20.5			20.6			
49	12/02/2003			3.8	4.6	0.1	4.5	2951-5	6.76	7.18	5.57	0.9	19.8						
50	12/03/2003	9045	6347	3.8	4.6	0.5	4.1	2951-5	6.56	7.04	6.21	2.3	23.2		0	20.2			
51	12/04/2003			3.5	4.6	0.5	4.1	37% 2954	6.66	7.05		2.5	21.0						
52	12/05/2003	10180	7241	3.8	4.6	0.8	3.8	100% 2954	6.83	7.23	5.02	1.5	21.1	220		17.2			
53	12/06/2003			4.8	13.8		13.8	2954	6.75										
54	12/07/2003			4.4		4.5	-4.5	2954	6.65	7.01	5.40	5.5	22.1						
55	12/08/2003	9514	6650	2.9	4.5	0	4.5	2954	6.54	7.03		3.4	20.8			19.2			
56	12/09/2003			3.8	4.6	0.2	4.4	2954	6.72	7.00	5.16	4.1	20.9						
57	12/10/2003	9306	6329	3.7	4.6	0.2	4.4	2954	6.62	6.86	5.14	3.7	20.1	220		17.3			
58	12/11/2003			4.0	4.6	0	4.6	2954	6.43	6.90	5.43	2.6	21.6						
59	12/12/2003	9567	6528	3.2	4.6	0.5	4.1	2954	6.79	6.84	5.50	4.1	20.6			17.4			
60	12/13/2003			3.8	13.8	10.1	3.7	2954	6.59			3.4	21.2						
61	12/14/2003			5.0	10.1	5	5.1	2954	6.62			3.6	21.4						

						Chambers Works #9 NP4XC
		pH controllers				
		INITIAL	FINAL	Bicarb		
DAY	DATE	Bicarb	Bicarb	con-sumed	Waste Vol	
		mL	mL	mL	mL	COMMENTS
32	11/15/2003	200	200	0		clear, no foam
33	11/16/2003	200	200	0		same, corrected pH calibration
34	11/17/2003	200	200	0	50	slight white scummy foam, slight odor
35	11/18/2003	200	190	10		clear supernate, no foam -- Switched feed to 2951
36	11/19/2003	190	175	15	50	clear, no foam
37	11/20/2003	175	175	0		very clear supernate, some floating scum in clarifier, no foam
38	11/21/2003	175	175	0	50	very clear, no foam
39	11/22/2003	175	175	0		same
40	11/23/2003	175	150	25		same
41	11/24/2003	150	150	0		very clear supernate, 1" blanket of floating scum in clarifier, no foam
42	11/25/2003	150	150	0		same with less floating scum
43	11/26/2003	150	150	0		same -- not feeding, replaced tubing
44	11/27/2003	150	150	0		same
45	11/28/2003	150	150	0		same
46	11/29/2003	150	150	0		same, slight NCH odor
47	11/30/2003	150	150	0		clear, no foam, nothing floating in clarifier
48	12/01/2003	150	150	0		same
49	12/02/2003	150	150	0		same, increased air "15" to "17" -- BEGAN FEEDING DRUM 5 FROM 2951
50	12/03/2003	150	150	0		clear supernate, no foam -- Switched feed to 2951
51	12/04/2003	150	150	0		same -- SWITCHED FEED TO 37% 2954
52	12/05/2003	150	150	0		same -- SWITCHED FEED ENTIRELY TO 2954
53	12/06/2003	150	150	0		same
54	12/07/2003	150	150	0		same, decreased air "15" to "13"
55	12/08/2003	150	150	0		same, decreased air "13" to 10"
56	12/09/2003	150	150	0		same
57	12/10/2003	150	150	0		crystal clear supernate, no foam
58	12/11/2003	150	150	0		same -- BEGAN ADDING 10 mg/L NH4Cl-N TO FEED FOR ALL REACTORS
59	12/12/2003	150	150	0		same except for small amount of floating solids in clarifier
60	12/13/2003	150	150	0		same, with floating solids
61	12/14/2003	150	150	0		very clear, no foam, no floating solids

		Chambers Works #9 NP4XC																
		FEED																
DAY	DATE	Feed DOC sol	COD tot	COD, sol	BOD, sol	NO2-N	NO3-N	NH3-N	TN, inst	TDS	SO4	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
62	12/15/2003	283		853		<1	<.5		42		815	5.4	52.0	38.6	154.4	25	8.01	
63	12/16/2003	292							42	2220								
64	12/17/2003	300	1008	637	365				46			4.2	49.0	36.8	147.2		8.00	52.0
65	12/18/2003	344				<1	6.87	36	63		750					24	7.74	
66	12/19/2003	358		1089					75			0.0	41.0	41.0	164.0			
67	12/20/2003																	
68	12/21/2003																	
69	12/22/2003	399	1252	1208		<1	13.99		83		2130	0.3				21	6.81	
70	12/23/2003	407							83	5807								
71	12/24/2003																	
72	12/25/2003																	
73	12/26/2003	407			500	<1	13.82				2081					20	6.39	
74	12/27/2003																	
75	12/28/2003																	
76	12/29/2003	395		1224		<1	14.08		87		2101	0.5	70.4	63.3	253.2	20	6.58	72.0
77	12/30/2003	357						41	70	6173								
78	12/31/2003	409	1297	986	480				83			0.3	48.0	41.2	164.6		6.60	
79	01/01/2004																	
80	01/02/2004	401		949		<1	13.88		85		2081					20		
81	01/03/2004																	
82	01/04/2004																	
83	01/05/2004	481		1447		<1	<.5		80		2601	3.6	57.0	53.4	213.5	26		
84	01/06/2004	325							62	8540								
85	01/07/2004	458	1520	1369	613				77			2.2	57.0	54.8	219.0			
86	01/08/2004	458																
87	01/09/2004																	

		Chambers Works #9 NP4XC																			
		EFFLUENT																			
DAY	**DATE**	**Eff 9 DOC**	**COD tot**	**Eff 9 COD, sol**	**Eff 9 BOD, sol**	**NH3-N**	**TN, inst**	**TSS**	**VSS**	**TDS**	**NO2-N**	**NO3-N**	**SO4**	**PO4-P, IC**	**PO4-P, Hach**	**Phos-phon-ate-P**	**EMPA-P**	**EMPA**	**MPA**	**MPA-P**	**Total P**
		mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**Calc**		**mg/l**	**mg/l**	**mg/L**
62	12/15/2003	169		412			41				<1	<.5	894	3.22		54	3.9	15.6	145.2	46.9	
63	12/16/2003	170					41			2147											
64	12/17/2003	172	409	223	14		43	22	5							47	0.0	0.0		47.0	47.0
65	12/18/2003	166				29.1	38				<1	<.5	863	3.21					141.4	45.7	
66	12/19/2003	168		336			46	24	2							48	48.0	192.0			
67	12/20/2003																				
68	12/21/2003																				
69	12/22/2003	159	297	407			60	17	17		<1	10.6	2122	0.9		40	-0.1	-0.4	121.4	39.2	
70	12/23/2003	183					68														
71	12/24/2003																				
72	12/25/2003																				
73	12/26/2003	208		497	12		74	22	2		<1	12.5	2326	0.9		46	-1.8	-7.2	145.2	46.9	
74	12/27/2003																				
75	12/28/2003																				
76	12/29/2003	198		509			78	37	15		<1	10.93	2206	0.9		48	1.0	4.1	142.7	46.1	46.8
77	12/30/2003	215				47.5	85			6253											
78	12/31/2003	223	558	407	13		83	30	20							53	6.9	27.6		46.1	
79	01/01/2004																				
80	01/02/2004	228		403			91	33	6		<1	12.94	2235	0.9		48	-0.6	-2.2	147.6	47.7	
81	01/03/2004	211					79														
82	01/04/2004	217					72														
83	01/05/2004	222		533			72	26	10		<1	7.61	2334	0.9		52	1.8	7.3	152.6	49.3	
84	01/06/2004	228					69			7953											
85	01/07/2004	226	560	512	15	45.2	71	23	10							51	51.0	204.0			
86	01/08/2004	158					56				<1	0.67	2931	<1					129.6	41.9	
87	01/09/2004																				

		Chambers Works #9 NP4XC																	
		UNIT PERFORMANCE			FEED VOL												pH controllers		
																	INITIAL	FINAL	1.0N
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR	1.0N H2SO4	1.0N H2SO4	H2SO4 con-sumed
		mg/L	mg/L	L	L	L	L					mg/L		mL/L	mL/g	mg/L/hr	mL	mL	mL
62	12/15/2003	8519	5720	3.5	5	1	4	2954	6.67	6.71	5.31	4.5	21.3			12.9			
63	12/16/2003			4.2	4.6	0.3	4.3	2954	6.64	6.84	4.97	4.0	20.9						
64	12/17/2003	8649	6122	4.2	4.6	0.3	4.3	2954	6.56	6.94	4.84	1.0	22.0		0	17.9			
65	12/18/2003			4.0	4.6	0.3	4.3	50% 2959	6.54	6.89	5.03	2.0	20.7						
66	12/19/2003	9708	6843	3.2	4.6	0	4.6	2959	6.32	6.96	4.72	0.5	21.3			19.7			
67	12/20/2003			4.2	13.8	9.9	3.9	2959	6.77			5.4	22.4						
68	12/21/2003			5.0	9.9	4.5	5.4	2959	6.57			3.4	21.5						
69	12/22/2003	10689	7508	2.8	4.5	0	4.5	2959	6.73	6.90	4.93	4.0	21.4			23.2			
70	12/23/2003			4.0	4.6	0.5	4.1	2959	6.62	6.77		5.2	21.6						
71	12/24/2003			5.6	13.8	8.3	5.5	2959	6.52										
72	12/25/2003				8.3	5	3.3	2959											
73	12/26/2003	9578	6691	6.4	5	1	4	2959	6.74	6.71	5.07	5.3	22.4			24.6			
74	12/27/2003			4.4	13.8	9	4.8	2959	6.61	7.03		4.5	22.8						
75	12/28/2003			5.0	9	3.7	5.3	2959	6.73	6.86	4.78	4.8	22.6						
76	12/29/2003	9284	6439	2.3	3.7	0.5	3.2	2959	6.64	6.86	4.92	4.9	22.5	270	29	27			
77	12/30/2003			3.8	4.6	0.2	4.4	2959	6.63	6.94	4.82	7.5	22.4						
78	12/31/2003	9310	6423	3.5	4.6	0	4.6	2959	6.72	6.76	5.24	7.2	21.8			23.1			
79	01/01/2004				9.2	5	4.2	2959											
80	01/02/2004	9351	6459	8.0	5	1	4	2959/2966	6.51	6.80	5.23	6.4	22.8			16.1			
81	01/03/2004			5.3	13.8	8	5.8	2959/2967	6.64	6.96		4.8	22.5						
82	01/04/2004			4.3	8	3.7	4.3	2959/2968	6.57	6.81	6.29	4.9	22.7						
83	01/05/2004	9054	6269	2.0	3.7	1	2.7	2966	6.81	6.96	5.79	7.5	22.3	290	32	26.9			
84	01/06/2004			3.7	4.6	0.5	4.1	2966	6.62	7.05		3.0	22.0						
85	01/07/2004	7781	5325	3.3	4.6	0	4.6	2966	6.74	7.07	6.88	2.1	21.6			24.2			
86	01/08/2004			4.0	4.6	0.5	4.1	2966	6.84	7.21		2.1	22.5						
87	01/09/2004							2966											

						Chambers Works #9 NP4XC
		pH controllers				
		INITIAL	FINAL	Bicarb		
DAY	DATE	Bicarb	Bicarb	con- sumed	Waste Vol	
		mL	mL	mL	mL	COMMENTS
62	12/15/2003	150	150	0		same
63	12/16/2003	150	150	0		same, lowered air "10" to "8"
64	12/17/2003	150	150	0		Clear, no foam. Raised air
65	12/18/2003	150	150	0		SWITCHED FEED TO 50% 2959 (NOT adding NH4Cl to new tote) -- Looks great, clear super
66	12/19/2003	150	140	10		SWITCHED FEED ENTIRELY TO 2959 -- Same
67	12/20/2003	140	100	40		Same, pale yellow
68	12/21/2003	100	100	0		Crystal clear eff, slite yellow.
69	12/22/2003	100	100	0		Same
70	12/23/2003	100	100	0		Very clear, thin layer of floating sludge
71	12/24/2003	100	100	0		Very clear super, 1" floating solids in clar
72	12/25/2003	100	100	0		
73	12/26/2003	100	70	30		Two inch floatin solids in clar, some foam
74	12/27/2003	250	250	0		Same, super clear
75	12/28/2003	250	240	10		2" settled solids and 1" floating solids. Translucent yellow
76	12/29/2003	240	240	0		No floaters today, clear super
77	12/30/2003	240	240	0		Some floating, clear super
78	12/31/2003	240	230	10		Lowered air, some floaters in clar. Very clear super
79	01/01/2004	230	230	0		
80	01/02/2004	230	225	5		start 30% drum 2966-1. 2" floaters, clear super
81	01/03/2004	225	225	0		Same
82	01/04/2004	225	225	0		20% settled solids in clar. And 1" solids floating on surface.. Translucent with little turbidity
83	01/05/2004	225	225	0		start 100% drum 2966-1. Clear yellow super, some sludge bergs. No foam, some yellow crust on walls.
84	01/06/2004	225	225	0		Same
85	01/07/2004	225	225	0		Very clear supernate, some floating solids. No foam
86	01/08/2004	225	225	0		Same, very nice. Eff saved for toxicity testing
87	01/09/2004			0		**End of test 1/8 Rxs sacrificed for cakes and odor panel.**

		Chambers Works #10 NBC																
		FEED																
DAY	DATE	Feed DOC sol	COD tot	COD, sol	BOD, sol	NO2-N	NO3-N	NH3-N	TN, inst	TDS	SO4	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
1	10/15/2003																	
2	10/16/2003	372							97									
3	10/17/2003	358		932	589				81			8.1						
4	10/18/2003																	
5	10/19/2003																	
6	10/20/2003	348	1313	1030					76			7.9						
7	10/21/2003	331							111	2867								
8	10/22/2003	333		1156	547				109			6.2	7.3	1.1	4.5			
9	10/23/2003	259							67									
10	10/24/2003	508		1112		<1	<.5	30.3	111		1614	4.2	18.2	11.8	47.2	7	2.24	
11	10/25/2003																	
12	10/26/2003																	
13	10/27/2003	338	1455	1224		<1	<.5		91		1607	4.2	20.2	14.0	55.9	6.35	2.05	23.0
14	10/28/2003	273							76	2893								
15	10/29/2003	213		1264	777	<1	<.5		60		1586	5.4	20.3	13.2	52.6	5.48	1.77	
16	10/30/2003	542							95									
17	10/31/2003	401		866		19.28	<.5		87		640	3.7	18.3	12.7	51.0	5.81	1.88	
18	11/01/2003																	
19	11/02/2003																	
20	11/03/2003	259	1132	700		18.98	<.5		55		611	3.1	18.8	13.8	55.1	6.08	1.96	
21	11/04/2003	240							49	4073								
22	11/05/2003	234		809	256				47				18.8	16.9	67.6		1.90	
23	11/06/2003	251				11.97	<.5	17.88	47		610					5.94	1.92	
24	11/07/2003	201							37			4.3	17.8	11.6	46.2		1.90	
25	11/08/2003																	
26	11/09/2003																	
27	11/10/2003	197	795	667		<1	<.5		37		667	2.1	19.5	15.5	62.1	6	1.91	
28	11/11/2003	218							32	3893								
29	11/12/2003	234		688	405				30			3.4	19.4	14.2	57.0		1.80	
30	11/13/2003	194				<1	<.5	13	27		720					6	1.80	
31	11/14/2003	171		585					47			3.4	19.4	14.3	57.0		1.80	

		Chambers Works #10 NBC																			
		EFFLUENT																			
DAY	DATE	Eff 10 DOC	COD tot	Eff 10 COD, sol	Eff 10 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
1	10/15/2003																				
2	10/16/2003	40					80														
3	10/17/2003	41		140	4		58	32	15		<1	7.68	2066	3.87	4.05				<2.5		
4	10/18/2003																				
5	10/19/2003																				
6	10/20/2003	45	150	64			60	41	20		2.41	30.1	1651	4.81	5.07				<2.5		
7	10/21/2003	59					79			3320											
8	10/22/2003	67		68			84	44	20		2.87	28.61	1580	4.05					<2.5		
9	10/23/2003	68					68														
10	10/24/2003	82		156		9.8	78	50	27		1.63	33.87	1561	3.61					<2.5		
11	10/25/2003																				
12	10/26/2003																				
13	10/27/2003	163	398	226			95	76	49		<1	42.21	1634	2.91		19	14.3	57.1	5.59	1.81	17.6
14	10/28/2003	73					63			3427											
15	10/29/2003	73		201	27		63	91	51		<1	51	1550	2.8		14.8	9.8	39.1	6.88	2.22	
16	10/30/2003	136					82														
17	10/31/2003	235		253			99	76	44		<1	44.75	1583	3.07		15.1	8.8	35.3	9.91	3.20	
18	11/01/2003																				
19	11/02/2003																				
20	11/03/2003	91	284	252			50	77	47		<1	32.73	742	2.3		14.5	9.2	36.9	9.21	2.97	
21	11/04/2003	93					51			3973											
22	11/05/2003	85		282	21		46	235	150							15.5	9.7	38.8		5.80	
23	11/06/2003	83				9.16	39				<1	25.67	636	3.41					18.07	5.84	
24	11/07/2003	78					38	42	15							16.4	10.6	42.4		5.80	
25	11/08/2003																				
26	11/09/2003																				
27	11/10/2003	67	306	306			25	48	4		<1	15.57	674	3.74		13.8	0.5	2.2	29.48	9.52	
28	11/11/2003	79					19			3847											
29	11/12/2003	73		229	1		17	50	19							14.8	3.2	12.8		11.60	
30	11/13/2003	72				4.86	17				<1	13.51	707	2.99					35.86	11.58	
31	11/14/2003	72		228			17	22	13							15.8	4.2	16.8		11.60	

		Chambers Works #10 NBC																	
		UNIT PERFORMANCE			FEED VOL														
																	pH controllers		
																	INITIAL	FINAL	1.0N
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR	1.0N H2SO4	1.0N H2SO4	H2SO4 con-sumed
		mg/L	mg/L	mL	L	L	L					mg/L		mL/L	mL/g	mg/L/hr	mL	mL	mL
1	10/15/2003								**6.62**			**4.8**	23.0						
2	10/16/2003			3.5	4.6	0	4.6	2941	6.65	7.48	5.46	2.0	22.1				250	250	0
3	10/17/2003	14566	9311	3.8	4.6	1	3.6	2941	6.67	7.41	5.65	0.3	22.7			43.9	250	250	0
4	10/18/2003			7.9	14.6	6	8.6	2941	6.77	7.28	6.06	2.9	18.5				250	250	0
5	10/19/2003			4.0	6	2	4	2941	6.32	7.15	6.42	6.5	19.9				250	225	25
6	10/20/2003	13863	8809	2.3	2	0	2	2941	6.10	6.79	6.04	2.9	20.5			39.8	225	225	0
7	10/21/2003			4.0	4.6	0.8	3.8	2941	6.47	6.84	6.01	2.7	20.6				225	225	0
8	10/22/2003	14926	9889	4.3	4.6	0.2	4.4	2941	6.23	7.10	5.60	2.0	20.5			44.8	225	200	25
9	10/23/2003			4.5	4.6	0	4.6	2941	6.40	6.96		1.4	22.6				200	200	0
10	10/24/2003	15758	10425	4.0	4.6	0.8	3.8	2941	6.23	6.88	5.71	3.5	23.6			61.7	200	200	0
11	10/25/2003			5.2	14.1	9	5.1	2941	6.46			2.5	23.3				200	200	0
12	10/26/2003			4.5	9	4	5	2941	6.50	7.03	6.20	4.8	21.3				200	200	0
13	10/27/2003	13334	8890	3.6	4	0	4	2941	6.58	6.79	5.99	5.0	21.0				200	200	0
14	10/28/2003			4.3	4.6	0.5	4.1	2941	6.55	6.84		4.7	22.3				200	200	0
15	10/29/2003	14185	9454	4.3	4.6	0.5	4.1	2941	6.46	6.75	5.27	4.7	21.8			55.6	200	200	0
16	10/30/2003			3.7	4.6	1	3.6	2941	6.46	6.78	5.46	4.6	22.3				200	200	0
17	10/31/2003	12620	8668	4.2	4.6	0.5	4.1	**2947-1a**	6.45	6.86	5.66	2.8	22.5			29.5	200	200	0
18	11/01/2003			5.1	14	8	6	2947-1a	6.42	6.71	5.66	5.6	21.9				200	200	0
19	11/02/2003			4.9	8	3.8	4.2	2947-1a	6.55	6.63	5.66	6.6	21.3				200	200	0
20	11/03/2003	10988	7391	3.0	3.8	0	3.8	2947-1a	6.55	6.82	5.81	6.4	21.6			19.2	200	200	0
21	11/04/2003			4.3	4.6	0	4.6	**2947-1b**	6.49	6.79	5.50	3.4	21.5				200	200	0
22	11/05/2003	10174	6963	4.2	4.6	0.8	3.8	2947-1b	6.48	6.78	5.46	5.1	21.5	220		26.7	200	200	0
23	11/06/2003			4.5	4.6	0	4.6	2947-1b	6.45	6.85		5.2	21.5				200	200	0
24	11/07/2003	10707	7201	4.7	4.6	0	4.6	**2947-1c 60%**	6.27	6.70			21.3		0	13.1	200	200	0
25	11/08/2003			5.0	14	7.6	6.4	2947-1c 60%	6.27	6.74	6.00	4.1	22.0				200	200	0
26	11/09/2003			4.7	7.6	4	3.6	2947-1c 60%	6.28			4.7	236.0				200	200	0
27	11/10/2003	10786	7200	3.8	4	0	4	**2947-1c**	6.51	6.68	5.81	4.6	23.3			17.1	200	200	0
28	11/11/2003			3.8	4.6	0.5	4.1	**2947-1d 50%**	6.40	6.83		4.2	23.4				200	200	0
29	11/12/2003	10968	7481	3.8	4.6	0.8	3.8	2947	6.63	7.14	6.24	4.8	21.4	180	16	14	off	off	off
30	11/13/2003			3.8	4.6	0.4	4.2	2947	6.67	7.11	5.56	3.8	20.6						0
31	11/14/2003	7740	5157	4.4	4.6	0.2	4.4	2947	6.56	7.04	5.91	3.8	22.5			15.2			0

						Chambers Works #10 NBC
		pH controllers				
		INITIAL	FINAL	Bicarb		
DAY	DATE	Bicarb	Bicarb	con-sumed	Waste Vol	
		mL	mL	mL	mL	COMMENTS
1	10/15/2003					
2	10/16/2003	175	175	0		start feeding CW ww
3	10/17/2003	175	175	0		looks good
4	10/18/2003	175	175	0		supernate is clearing Rx looks good, Inc air
5	10/19/2003	175	175	0		feed too fast, lkowered. Foaming probably due to feed rate
6	10/20/2003	175	175	0		still foaming, rate looks good, lowered do
7	10/21/2003	175	175	0		looks good, thin scummy foam in aerator
8	10/22/2003	175	170	5		turbid supernate, aerator has 1/4" scummy foam.
9	10/23/2003	170	150	20		little foam, clear effluent
10	10/24/2003	150	150	0		1/2" scummy foam, turbid clarifier, BEGAN FEEDING NCH (3.8mL NB/4.6mL FEED)
11	10/25/2003	150	100	50		a little foam, turbid clarifier with floating solids
12	10/26/2003	250	250	0		pH alarm on, Bicarb tubing curled, no odor to Rx or effluent. Thick black foam, added antifoam
13	10/27/2003	250	230	20		floating solids in clarifier, turbid supernate, 1 1/2" dark foam in aerator, added 1 drop 1/10 antifoam
14	10/28/2003	230	220	10		turbid, foamy
15	10/29/2003	220	200	20		turbid, foamy, floating solids in clarifier
16	10/30/2003	200	175	25	500	1 1/2" scummy foam, thick blanket of floating solids on turbid clarifier, 1 drop AF
17	10/31/2003	175	175	0	500	1 1/2" scummy foam, 3/4" blanket of floating solids , 1 drop AF -- **SWITCHED FEED TO 2947**
18	11/01/2003	175	175	0		heavy dark foaming, small amt. Floating solids on clarifier, 2 drops AF
19	11/02/2003	175	175	0		1 1/2" scummy foam, cloudy clarifier
20	11/03/2003	175	175	0		clarifier dark and scummy, aerator foaming to top of Rx, lowered air to "20"
21	11/04/2003	175	175	0		Scummy foam to top of aerator, added 2 drops AF, clarifier dark -- FEED DRUM CHANGED TO 1b
22	11/05/2003	175	175	0		2" scummy foam, turbid supernate
23	11/06/2003	175	175	0		thick scummy foam, turbid supernate
24	11/07/2003	175	170	5	100	FEED DRUM CHANGED TO 60% 1c, 40% 1b -- turbid supernate, evidence of heavy foaming but none now
25	11/08/2003	170	170	0		1" black foam, 20% solids in clarifier and turbid, 2 drops 1/10 AF
26	11/09/2003	170	170	0		1/2-1" scummy foam, turbid clarifier
27	11/10/2003	170	170	0	100	FEED DRUM CHANGED TO 1c -- cloudy supernate, 3/4" scummy foam
28	11/11/2003	170	160	10		FEED DRUM CHANGED TO 50% 1d, 50% 1c -- scummy foam, turbid supernate
29	11/12/2003	160	160	0	100	1/2" scummy foam, slightly turbid clarifier, decreased air from "19" to "17"
30	11/13/2003	160	150	10		1" very scummy foam, slightly turbid clarifier
31	11/14/2003	150	150	0	100	same

		Chambers Works #10 NBC																
		FEED																
DAY	DATE	Feed DOC sol	COD tot	COD, sol	BOD, sol	NO2-N	NO3-N	NH3-N	TN, inst	TDS	SO4	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
32	11/15/2003																	
33	11/16/2003																	
34	11/17/2003	184		645		<1	1.48		31		654	5.8	21.4	13.7	54.7	6	1.95	
35	11/18/2003	292							61	2147								
36	11/19/2003	282	929	921	616				59			4.5	18.0	11.5	46.0		2.00	
37	11/20/2003	262				<1	9.75	27	57		779					5	1.76	
38	11/21/2003	279							57			1.9	14.7	11.0	43.9		1.80	
39	11/22/2003																	
40	11/23/2003																	
41	11/24/2003	296		910		3.48	7.02		59		908		18.2	16.4	65.5	6	1.83	
42	11/25/2003	284						29	57	2200								
43	11/26/2003	270	927	890	616	7.89	1.39		52		877	3.6	16.8	12.3	49.1	3	0.91	
44	11/27/2003																	
45	11/28/2003																	
46	11/29/2003																	
47	11/30/2003																	
48	12/01/2003	265		887		6.98	<.5		52		918					6	1.98	
49	12/02/2003	261							43	2307								
50	12/03/2003	252	861	801	616				42			2.0	16.3	12.3	49.4		2.00	17.5
51	12/04/2003	143				<1	0.66		24		801					<2.5		
52	12/05/2003	145		612				13	16			5.5	18.1	12.6	50.5			
53	12/06/2003																	
54	12/07/2003																	
55	12/08/2003	171		583		<1	1.13		14		658	4.3	18.2	11.5	46.2	7	2.36	
56	12/09/2003	163							14	1680								
57	12/10/2003	153	610	560	177				13			6.2	20.1	11.5	46.2		2.40	20.8
58	12/11/2003	152				<1	<.5	24	27		631					7	2.36	
59	12/12/2003	167		563					26			5.5	24.3	16.4	65.6		2.40	
60	12/13/2003	167																
61	12/14/2003	167																

		Chambers Works #10 NBC																			
		EFFLUENT																			
DAY	DATE	Eff 10 DOC	COD tot	Eff 10 COD, sol	Eff 10 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
32	11/15/2003																				
33	11/16/2003																				
34	11/17/2003	65		254			38	49	21		<1	25.42	699	1.78		13.5	1.2	4.8	32.6	10.53	
35	11/18/2003	65					32			4520											
36	11/19/2003	69	214	252	19		29	25	12							15.4	4.0	16.0		11.40	
37	11/20/2003	77				18.56	30				<1	7.52	869	2.62					35.37	11.42	
38	11/21/2003	80					35	41	21							14.7	3.3	13.2		11.40	
39	11/22/2003																				
40	11/23/2003																				
41	11/24/2003	83		282			31	29	26		<1	4.31	979	0.81		13.5	1.1	4.4	35.86	11.58	
42	11/25/2003	84				24.33	33			2273											
43	11/26/2003	104	378	153	33		37	60	41		<1	1.47	996	1.22		14.5	2.7	10.8	32.78	10.59	
44	11/27/2003																				
45	11/28/2003																				
46	11/29/2003																				
47	11/30/2003																				
48	12/01/2003	119		348			32	69	46		<1	<.5	1024	1.1					20.46	6.61	
49	12/02/2003	110					29			2533											
50	12/03/2003	109	359	267	70		27	72	50							13.4	6.8	27.2		6.60	14.3
51	12/04/2003	113					30				<1	<.5	1011	0.76					20.89	6.75	
52	12/05/2003	108		339		18.21	28	80	57							14	7.3	29.2		6.70	
53	12/06/2003																				
54	12/07/2003																				
55	12/08/2003	84		273		7.42	7	69	42		<1	<.5	753	1.49		15.3	6.2	25.0	23.45	7.57	
56	12/09/2003	76					4			1607											
57	12/10/2003	77	312	215	14		2									16.1	7.8	31.2		8.30	17.0
58	12/11/2003	79				7.88	2				<1	<.5	674	2.36					25.77	8.32	
59	12/12/2003	81		178			5									19.6	11.3	45.2		8.30	
60	12/13/2003	84					10														
61	12/14/2003	83					19														

		Chambers Works #10 NBC																	
		UNIT PERFORMANCE			FEED VOL														
																	pH controllers		
																	INITIAL	FINAL	1.0N
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR	1.0N H2SO4	1.0N H2SO4	H2SO4 con-sumed
		mg/L	mg/L	mL	L	L	L					mg/L		mL/L	mL/g	mg/L/hr	mL	mL	mL
32	11/15/2003			4.0	13.8	10	3.8	2947	6.49	7.13	5.88	4.1	21.1						0
33	11/16/2003			5.5	10	4	6	2947	6.57	7.03	6.12	3.6	21.9						0
34	11/17/2003	10263	7000	3.2	4	0.6	3.4	2947	6.72	7.26	5.81	2.2	20.9			15.4			0
35	11/18/2003			3.4	4.6	1	3.6	2951	6.49	7.25	5.38	0.2	21.5						0
36	11/19/2003	9323	6407	3.5	4.6	1	3.6	2951	6.70	7.19	5.53	0.1	20.7	190	20	14.8			0
37	11/20/2003			3.4	4.6	1	3.6	2951	6.68	7.19	6.18	3.6	20.1						0
38	11/21/2003	7719	5249	4.6	4.6	0	4.6	2951	6.73	7.04	6.42	2.8	21.5			13.2			0
39	11/22/2003			4.5	13.8		13.8	2951											0
40	11/23/2003			4.0	9.5	5	4.5	2951	7.01			3.2	22.2						0
41	11/24/2003	9254	6456	4.5	5	0	5	2951	7.34	7.55		4.4	23.2			24.6			0
42	11/25/2003			4.0	4.6	0	4.6	2951	7.02	7.51	5.62	3.5	22.4						0
43	11/26/2003	9374	6558	4.0	4.6	0	4.6	2951	7.00	7.42	5.98	3.9	21.1	180	19	16.6			0
44	11/27/2003				18.4		18.4	2951											0
45	11/28/2003						0	2951											0
46	11/29/2003			3.3		5.9	-5.9	2951	6.93			4.3	21.4						0
47	11/30/2003			3.7	5.9	1	4.9	2951	7.31			5.5	20.3						0
48	12/01/2003	8825	6195	4.2	4.6	0	4.6	2951	7.00	7.41	5.71	4.1	20.3			19.4			0
49	12/02/2003			4.2	4.6	0	4.6	2951-5	6.81	7.29	5.78	0.8	250.2						0
50	12/03/2003	10246	7143	4.0	4.6	0.5	4.1	2951-5	6.70	7.14	6.55	2.7	23.0		0	13.2			0
51	12/04/2003			4.0	4.6	0	4.6	37% 2954	6.65	7.06		2.8	21.2						0
52	12/05/2003	12372	8721	3.9	4.6	0.9	3.7	100% 2954	6.67	7.08	5.50	3.2	20.3	215		11.9			0
53	12/06/2003			5.1	13.8		13.8	2954	6.60										0
54	12/07/2003			4.7		4	-4	2954	6.63	6.86	5.87	4.9	22.2						0
55	12/08/2003	11201	7811	3.2	4	0.2	3.8	2954	6.62	6.98		5.1	21.5			12.9			0
56	12/09/2003			3.4	4.6	0.5	4.1	2954	6.59	6.93	5.72	5.0	21.4						0
57	12/10/2003	10730	7467	4.1	4.6	0.2	4.4	2954	6.53	6.86	5.75	3.7	20.6	190		12.1			0
58	12/11/2003			4.2	4.6	0	4.6	2954	6.36	6.94	6.36	2.6	21.5						
59	12/12/2003	10485	7298	4.2	4.6	0	4.6	2954	6.54	6.82	5.95	3.7	20.7			10.5			
60	12/13/2003			4.0	13.8	10	3.8	2954	6.46			4.0	21.2						
61	12/14/2003			5.2	10	3.9	6.1	2954	6.52			2.2	21.6						

						Chambers Works #10 NBC
		pH controllers				
		INITIAL	FINAL	Bicarb		
DAY	DATE	Bicarb	Bicarb	con-sumed	Waste Vol	
		mL	mL	mL	mL	COMMENTS
32	11/15/2003	150	150	0		same, 2 drops 1/10 AF
33	11/16/2003	150	150	0		same, lowered air from "15" to "12", 2 drops 1/10 AF
34	11/17/2003	150	140	10	50	no foam, turbid supernate, very slight odor
35	11/18/2003	150	150	0		no foam, turbid supernate -- Switched feed to 2951
36	11/19/2003	150	150	0	50	medium turbidity, no foam, increased air "10" to "15"
37	11/20/2003	150	150	0		turbid, no foam
38	11/21/2003	150	150	0	50	slightly turbid, no foam
39	11/22/2003	150	150	0		same
40	11/23/2003	150	150	0		same
41	11/24/2003	150	150	0		1/2" blanket of floating solids on top of slightly turbid supernate, no foam
42	11/25/2003	150	150	0		slightly turbid, no foam, decreased air
43	11/26/2003	150	140	10		slighlty turbid, no foam
44	11/27/2003	140	140	0		same
45	11/28/2003	140	140	0		same
46	11/29/2003	140	140	0		slightly turbid, very slight white foam, settles fast, no odor
47	11/30/2003	140	140	0		slightly turbid, thin foam
48	12/01/2003	140	140	0		same
49	12/02/2003	140	140	0		same -- BEGAN FEEDING DRUM 5 FROM 2951
50	12/03/2003	140	140	0		slightly turbid, no foam
51	12/04/2003	140	140	0		same -- SWITCHED FEED TO 37% 2954
52	12/05/2003	140	140	0		same -- SWITCHED FEED ENTIRELY TO 2954
53	12/06/2003	140	140	0		same
54	12/07/2003	140	140	0		same, decreased air "10" to "8"
55	12/08/2003	140	140	0		same, decreased air "8" to "5"
56	12/09/2003	140	140	0		slightly turbid, no foam
57	12/10/2003	140	140	0		slightly turbid, no foam
58	12/11/2003	140	140	0		same -- BEGAN ADDING 10 mg/L NH4Cl-N TO FEED FOR ALL REACTORS
59	12/12/2003	140	140	0		turbid, no foam
60	12/13/2003	140	140	0		same
61	12/14/2003	140	140	0		same

		Chambers Works #10 NBC																
		FEED																
DAY	DATE	Feed DOC sol	COD tot	COD, sol	BOD, sol	NO2-N	NO3-N	NH3-N	TN, inst	TDS	SO4	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
62	12/15/2003	154		573		<1	<.5		27		655	6.8	16.8	7.6	30.5	7	2.39	
63	12/16/2003	139							25	1840								
64	12/17/2003	147	529	417	281				24			5.4	18.3	10.5	42.2		2.40	18.8
65	12/18/2003	183				<1	6.78	27	45		1332					6	2.02	
66	12/19/2003	209		783					59			0.0	13.3	13.3	53.2			
67	12/20/2003																	
68	12/21/2003																	
69	12/22/2003	203	858	780		<1	14.07		58		1940	0.3	13.9	12.6	50.5	3	0.93	
70	12/23/2003	214							61	5780								
71	12/24/2003																	
72	12/25/2003																	
73	12/26/2003	214			436	<1	14.09				1896					3	0.92	
74	12/27/2003																	
75	12/28/2003																	
76	12/29/2003	221		783		<1	14.24		66		1908	0.8	18.5	16.4	65.7	4	1.28	17.9
77	12/30/2003	201						32	52	5513								
78	12/31/2003	246	816	668	443				65			0.4	12.6	10.9	43.7		1.30	
79	01/01/2004																	
80	01/02/2004	235		742		<1	14.25		62		1918					3	1.10	
81	01/03/2004																	
82	01/04/2004																	
83	01/05/2004	296		1056		<1	<.5		58		2408	2.7	5.2	0.8	3.3	5	1.70	
84	01/06/2004	321							62	8160								
85	01/07/2004	301	1158	1060	518				58				17.9	17.9	71.6			
86	01/08/2004	301																
87	01/09/2004																	

		Chambers Works #10 NBC																			
		EFFLUENT																			
DAY	DATE	Eff 10 DOC	COD tot	Eff 10 COD, sol	Eff 10 BOD, sol	NH3-N	TN, inst	TSS	VSS	TDS	NO2-N	NO3-N	SO4	PO4-P, IC	PO4-P, Hach	Phos-phon-ate-P	EMPA-P	EMPA	MPA	MPA-P	Total P
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/l	mg/l	mg/l	Calc		mg/l	mg/l	mg/L
62	12/15/2003	89		239			17				<1	<.5	697	2.77		18.6	5.6	22.3	31.77	10.26	
63	12/16/2003	79					17			1800											
64	12/17/2003	70	257	99	20		13	94	60							14.4	4.1	16.4		10.30	17.5
65	12/18/2003	72				14.67	13				<1	<.5	668	3.23					29.96	9.67	
66	12/19/2003	70		205			22	71	44							15	15.0	60.0			
67	12/20/2003																				
68	12/21/2003																				
69	12/22/2003	73	216	283			31	51	28		<1	<.5	1931	0.9		10.5	5.7	22.8	12.08	3.90	
70	12/23/2003	77					31														
71	12/24/2003																				
72	12/25/2003																				
73	12/26/2003	80		219	49		43	63	26		<1	<.5	2106	0.9		11	7.1	28.5	9.25	2.99	
74	12/27/2003																				
75	12/28/2003																				
76	12/29/2003	73		243			50	65	30		<1	0.62	1965	0.9		12.7	9.9	39.7	5.79	1.87	12.4
77	12/30/2003	80				25.07	53			5100											
78	12/31/2003	85	311	166	44		49	40	27							13.5	11.6	46.4		1.90	
79	01/01/2004																				
80	01/02/2004	80		232			56	44	7		9.37	3.17	2002	0.9		11.5	8.5	33.9	6.56	2.12	
81	01/03/2004	79					58														
82	01/04/2004	83					53														
83	01/05/2004	86		248			54	34	15		<1	<.5	2125	0.9		12	7.6	30.2	10.98	3.55	
84	01/06/2004	91					51			7020											
85	01/07/2004	92	335	264	20	33.23	51	258	20							13.9	13.9	55.6			
86	01/08/2004	87					50				<1	<.5	2792	<1					36.72		
87	01/09/2004																				

		Chambers Works #10 NBC														
		UNIT PERFORMANCE			FEED VOL											
DAY	DATE	MLSS	MLVSS	EFF VOL	INITIAL	FINAL	FEED USED	Drum ID	UNIT pH	EFF pH	FEED pH	DO	TEMP ºC	SSV	SVI	OUR
		mg/L	mg/L	mL	L	L	L					mg/L		mL/L	mL/g	mg/L/hr
62	12/15/2003	10660	7461	4.0	3.9	0.5	3.4	2954	6.64	6.77	5.67	3.6	21.3			10
63	12/16/2003			4.2	4.6	0.3	4.3	2954	6.60	6.80		4.1	21.2			
64	12/17/2003	10064	7216	4.4	4.6	0	4.6	2954	6.37	6.95	5.31	1.8	21.4		0	13
65	12/18/2003			4.4	4.6	0	4.6	50% 2959	6.32	6.76	5.55	1.0	20.9			
66	12/19/2003	9884	7077	4.2	4.6	0	4.6	2959	6.34	6.93	5.36	0.6	21.3			15.1
67	12/20/2003			3.3	13.8	9.9	3.9	2959	6.38			5.5	22.2			
68	12/21/2003			4.3	9.9	4.5	5.4	2959	6.44			1.4	21.4			
69	12/22/2003	10965	7815	3.2	4.5	0	4.5	2959	6.43	6.77	5.22	0.6	21.5			20.4
70	12/23/2003			3.6	4.6	0	4.6	2959	6.52	6.81		2.6	21.5			
71	12/24/2003			4.1	13.8	8.5	5.3	2959	6.50							
72	12/25/2003			5.8	8.5		8.5	2959								
73	12/26/2003	9782	6919		4	0.8	3.2	2959	6.48	6.64	5.32	2.6	22.3			15.2
74	12/27/2003			7.0	13.8	9	4.8	2959	6.54	7.06		1.6	22.8			
75	12/28/2003			4.4	9	4	5	2959	6.62	6.69	5.25	2.3	22.5			
76	12/29/2003	10227	7219	4.9	4	0.5	3.5	2959	6.57	6.57	5.06	1.6	22.5	220	22	17.9
77	12/30/2003			2.8	4.6	0.5	4.1	2959	6.57	7.02	5.09	5.2	22.6			
78	12/31/2003	11029	7619	3.9	4.6	0.2	4.4	2959	6.60	6.95	5.20	2.7	22.5			14.1
79	01/01/2004			4.0	9.2		9.2	2959								
80	01/02/2004	11761	8142	8.3		1	-1	2959/2966	6.51	6.91	5.04	2.6	22.7			18.4
81	01/03/2004			5.1	13.8	8	5.8	2959/2967	6.71	7.14		1.8	22.0			
82	01/04/2004			4.3	8	3.8	4.2	2959/2968	6.77	7.20	6.55	2.5	22.7			
83	01/05/2004	11170	7713	2.9	3.8	0.5	3.3	2966	6.93	7.41	5.89	2.9	22.2	260	23	18.2
84	01/06/2004			3.8	4.6	0.5	4.1	2966	6.81	7.44		1.9	22.1			
85	01/07/2004	10997	7573	3.3	4.6	0	4.6	2966	6.88	7.41	6.81	1.3	21.9			18.1
86	01/08/2004			4.0	4.6	0.5	4.1	2966	7.00	7.41		0.3	22.3			
87	01/09/2004						0	2966								

						Chambers Works #10 NBC
		pH controllers				
		INITIAL	FINAL	Bicarb		
DAY	DATE	Bicarb	Bicarb	con-sumed	Waste Vol	
		mL	mL	mL	mL	COMMENTS
62	12/15/2003	140	140	0		SWITCHED NCH LOAD TO SAME AS RX 8 (NPBI - 4.6mL treated sample / 4.6L Feed) -- turbid, no foam
63	12/16/2003	140	140	0		turbid, no foam - lowered air "5" to "4"
64	12/17/2003	140	140	0		Turbid, no foam
65	12/18/2003	140	140	0		SWITCHED FEED TO 50% 2959 (NOT adding NH4Cl to new tote) -- Same
66	12/19/2003	140	130	10		SWITCHED FEED ENTIRELY TO 2959 -- Bit less turbid
67	12/20/2003	130	125	5		Murky turbidity, adj pH controller and air
68	12/21/2003	125	125	0		Murky, no foam
69	12/22/2003	125	125	0		Same
70	12/23/2003	125	125	0		Same
71	12/24/2003	125	125	0		Turbid
72	12/25/2003	125	125	0		
73	12/26/2003	125	100	25		Slight turbid
74	12/27/2003	100	100	0		same
75	12/28/2003	100	100	0		20% settled solids in clar. Turbid eff
76	12/29/2003	100	90	10		Same
77	12/30/2003	90	90	0		Murky, yellow green
78	12/31/2003	90	90	0		greenish yellow, murky; no foam
79	01/01/2004	250	250	0		
80	01/02/2004	250	250	0		start 30% drum 2966-1. V. turbid
81	01/03/2004	250	250	0		same
82	01/04/2004	250	250	0		about 20% ss in clarifier and supernate is turbid
83	01/05/2004	250	250	0		start 100% drum 2966-1. Murky greenish yellow supernate
84	01/06/2004	250	250	0		same
85	01/07/2004	250	250	0		greenish & murky clarifier, v. thin foam
86	01/08/2004					DO low. Turbid, no foam. Eff saved for toxicity testing
87	01/09/2004					**End of test 1/8 Rxs sacrificed for cakes and odor panel.**

Appendix J.
Example of Tukey Method to Test Statistical Significance

All tests for statistical significance in this study were performed using the standard MINITAB® Statistical Software package (Release 13.31). The package allows means of results to be compared using Tukey's method for paired comparisons. If the confidence interval for the difference between the means includes zero (that is, the range goes from negative to positive values), then the means cannot be said to be significantly different statistically. If the confidence interval does not include zero (*i.e*, the upper and lower bound are either both negative or both positive), then the means are considered statistically different at the alpha criterion set (in all cases in this study, $\alpha = 0.05$).

The example provided below considers the DOC concentrations for the feeds to the bioreactors during the phase of the study in which only the reprocessed NCH was tested. In this case it can be seen that the only statistically significant difference in the means is for Reactor 9 as compared with all the other reactors. Reactor 9 was fed at 4X the base concentration of NCH. The matrix entries in which Reactor 9 is considered are the only entries in which the endpoints of the confidence range are either both positive or both negative. (This information is presented after the ANOVA diagram, which also gives a preliminary indication of overlapping ranges.)

One-way ANOVA: DOC in versus Rctr No

```
Analysis of Variance for DOC in
Source     DF        SS        MS        F        P
Rctr No     9    802468     89163    15.35    0.000
Error     360   2091472      5810
Total     369   2893940
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  -------+---------+---------+---------
 1         37    191.46     54.11   (--*---)
 2         37    232.38     66.63         (--*---)
 3         37    242.19     78.07          (---*--)
 4         37    217.97     82.78       (--*---)
 5         37    241.78     78.62          (---*--)
 6         37    227.43     81.39        (--*---)
 7         37    232.32     66.08         (--*---)
```

```
 8         37    238.62     79.69          (--*---)
 9         37    376.92     77.71                              (---*--)
10         37    242.78     90.67          (---*--)
                                   -------+---------+---------+---------
Pooled StDev =    76.22                 210       280       350

Tukey's pairwise comparisons

    Family error rate = 0.0500
Individual error rate = 0.00171

Critical value = 4.47

Intervals for (column level mean) - (row level mean)

                1           2           3           4           5           6

      2       -96.9
               15.1

      3      -106.7       -65.8
                5.3        46.2

      4       -82.5       -41.6       -31.8
               29.5        70.4        80.2

      5      -106.3       -65.4       -55.6       -79.8
                5.7        46.6        56.4        32.2

      6       -92.0       -51.1       -41.3       -65.5       -41.7
               20.0        61.0        70.8        46.6        70.4

      7       -96.9       -56.0       -46.1       -70.4       -46.6       -60.9
               15.1        56.1        65.9        41.7        65.5        51.1

      8      -103.2       -62.3       -52.4       -76.7       -52.8       -67.2
                8.8        49.8        59.6        35.4        59.2        44.8

      9      -241.5      -200.6      -190.7      -215.0      -191.1      -205.5
             -129.4       -88.5       -78.7      -102.9       -79.1       -93.5
```

10	-107.3	-66.4	-56.6	-80.8	-57.0	-71.4
	4.7	45.6	55.4	31.2	55.0	40.7

	7	8	9
8	-62.3		
	49.7		
9	-200.6	-194.3	
	-88.6	-82.3	
10	-66.5	-60.2	78.1
	45.6	51.8	190.1

Appendix K.
Odor Panel Results

All the results in this section include the statistical evalation using Tukey's method for paired comparisons to test for significant differences in the means of the results. If the confidence interval for the difference between the means includes zero (that is, the range goes from negative to positive values), then the means cannot be said to be significantly different statistically.

NCH Pretreatment Odor Panel – 10/10/2003

Sample ID:			Range Number: panelist # 1	2	3	4	5	6	7	8	Average	St Dev	Avg -1 St Dev	Avg +1 St Dev
B	**Untreated NCH**	**Untreated NCH**	**10**	**12**	**9**	**12**	**10**	**10**	**12**	**12**	**10.88**	1.25	9.63	12.12
A	**1 ml 10%H2O2**	**2%H2O2**	**6**	**10**	**5**	**6**	**7**	**11**	**7**	**6**	**7.25**	2.12	5.13	9.37
C	**5 ml 10%H2O2**	**10%H2O2**	**2**	**8**	**7**	**4**	**3**	**9**	**4**	**6**	**5.38**	2.50	2.87	7.88
D	1 ml 20% oxone	4% Oxone®	**10**	**12**	**6**	**11**	**10**	**11**	**12**	**12**	**10.50**	2.00	8.50	12.50
E	5ml 20% oxone	20% Oxone®	**6**	**11**	**3**	**9**	**5**	**9**	**3**	**8**	**6.75**	2.96	3.79	9.71
F	200 mg/L Fe + 10% H2	200 mg/L Fe + 10% H2	**6**	**7**	**6**	**9**	**3**	**8**	**8**	**8**	**6.88**	1.89	4.99	8.76
J	**STD (Actual: 9) 625 ppm**	**STD (Actual: 9) 625 ppm**	**6**	**10**	**8**	**9**	**8**	**7**	**8**	**8**	**8.00**	1.20	6.80	9.20
Average			**6.00**	**9.67**	**5.83**	**8.00**	**6.00**	**9.17**	**7.00**	**8.00**	**7.46**	1.49	5.97	8.95
Concentration, mg/L Butanol			2.5	5	10	20	40	78	156	313	625	1250	2500	5000
Jar #			1	2	3	4	5	6	7	8	9	10	11	12

One-way ANOVA: Prtrt Odor versus Pretrtmnt

```
Analysis of Variance for Prtrt Od
Source     DF        SS        MS        F        P
Pretrtmn    5    198.19     39.64     8.30    0.000
Error      42    200.63      4.78
Total      47    398.81
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  -----+---------+---------+---------+-
C1: Untr    8    10.875     1.246                         (------*-----)
C2: 2% P    8     7.250     2.121          (-----*-----)
C3: 10%     8     5.375     2.504   (------*-----)
C4: 4% O    8    10.500     2.000                        (-----*-----)
C5: 20%     8     6.750     2.964        (-----*-----)
C6: Fent    8     6.875     1.885        (------*-----)
                                   -----+---------+---------+---------+-
Pooled StDev =    2.186                5.0       7.5      10.0      12.5

Tukey's pairwise comparisons

    Family error rate = 0.0500
Individual error rate = 0.00473

Critical value = 4.22

Intervals for (column level mean) - (row level mean)

          C1: Untr    C2: 2% P    C3: 10%     C4: 4% O    C5: 20%

C2: 2% P       0.364
               6.886

C3: 10%        2.239      -1.386
               8.761       5.136

C4: 4% O      -2.886      -6.511      -8.386
               3.636       0.011      -1.864

C5: 20%        0.864      -2.761      -4.636       0.489
               7.386       3.761       1.886       7.011

C6: Fent       0.739      -2.886      -4.761       0.364      -3.386
               7.261       3.636       1.761       6.886       3.136
```

NCH Biotreatment Odor Panel – 12/11/2003

Sample ID:		Range Number: panelist # 1	2	3	4	5	6	7	8	Average	StDev	Average - 1 sigma	Average + 1 sigma	
M-7	NCH Rx 1 Control	8	7	7	6	3	6	4	6	5.88	1.64	4.23	7.52	Rx 1 Control
M-1	NCH Rx 2 NPSBC	4	7	9	8	6	4	4	5	5.88	1.96	3.92	7.83	Rx 2 NPSBC
M-8	NCH Rx 3 NPBC	8	5	8	5	3	4	4	5	5.25	1.83	3.42	7.08	Rx 3 NPBC
M-2	NCH Rx 4 NPLC	4	9	8	7	5	2	6	5	5.75	2.25	3.50	8.00	Rx 4 NPLC
M-9	NCH Rx 5 NABC	8	6	9	5	5	3	2	9	5.88	2.64	3.23	8.52	Rx 5 NABC
M-3	NCH Rx 6 FSBC	4	11	11	8	4	6	2	9	6.88	3.40	3.48	10.27	Rx 6 FSBC
M-10	NCH Rx 7 FBC	10	5	8	6	5	5	2	8	6.13	2.47	3.65	8.60	Rx 7 FBC
M-4	NCH Rx 8 NPBI	7	11	8	7	10	7	6	10	8.25	1.83	6.42	10.08	Rx 8 NPBI
M-11	NCH Rx 9 NP4xC	10	3	6	8	10	6	5	12	7.50	3.02	4.48	10.52	Rx 9 NP4xC
M-5	NCH Rx 10 NBC	4	5	7	5	4	5	2	9	5.13	2.10	3.02	7.23	Rx 10 NBC
	STD (7) 156 ppm	9	3	7	6	7	7	8	6	6.63	1.77	4.86	8.39	
Average		6.80	6.50	8.10	6.50	5.90	4.90	4.10	7.80	6.33	1.35	4.97	7.68	
Jar #		1	2	3	4	5	6	7	8	9	10	11	12	
Concentration, mg/L Butanol		2.5	5	10	20	40	78	156	313	625	1250	2500	5000	

One-way ANOVA: Dec Rctr Odor versus Rctr No

```
Analysis of Variance for Dec Rctr
Source     DF        SS        MS        F        P
Rctr No     9     71.25      7.92     1.40    0.205
Error      70    395.75      5.65
Total      79    467.00
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  ---+---------+---------+---------+---
1A          8     5.875     1.642      (-------*--------)
2A          8     5.875     1.959      (-------*--------)
3A          8     5.250     1.832   (-------*--------)
4A          8     5.750     2.252     (--------*-------)
5A          8     5.875     2.642      (-------*--------)
6A          8     6.875     3.399           (-------*--------)
7A          8     6.125     2.475       (--------*-------)
8A          8     8.250     1.832                  (-------*--------)
9A          8     7.500     3.024              (--------*-------)
z10A        8     5.125     2.100  (--------*-------)
                                   ---+---------+---------+---------+---
Pooled StDev =    2.378             4.0       6.0       8.0      10.0

Tukey's pairwise comparisons

    Family error rate = 0.0500
Individual error rate = 0.00169

Critical value = 4.62
```

Intervals for (column level mean) - (row level mean)

	1A	2A	3A	4A	5A	6A
2A	-3.884 3.884					
3A	-3.259 4.509	-3.259 4.509				
4A	-3.759 4.009	-3.759 4.009	-4.384 3.384			
5A	-3.884 3.884	-3.884 3.884	-4.509 3.259	-4.009 3.759		
6A	-4.884 2.884	-4.884 2.884	-5.509 2.259	-5.009 2.759	-4.884 2.884	
7A	-4.134 3.634	-4.134 3.634	-4.759 3.009	-4.259 3.509	-4.134 3.634	-3.134 4.634
8A	-6.259 1.509	-6.259 1.509	-6.884 0.884	-6.384 1.384	-6.259 1.509	-5.259 2.509
9A	-5.509 2.259	-5.509 2.259	-6.134 1.634	-5.634 2.134	-5.509 2.259	-4.509 3.259
z10A	-3.134 4.634	-3.134 4.634	-3.759 4.009	-3.259 4.509	-3.134 4.634	-2.134 5.634

	7A	8A	9A
8A	-6.009 1.759		
9A	-5.259 2.509	-3.134 4.634	
z10A	-2.884	-0.759	-1.509

4.884 7.009 6.259

NCH Biotreatment Odor Panel - 1/9/2004

Sample ID:		Range Number: panelist # 1	2	3	4	5	6	7	8	Average	StDev	Avg -1 sigma	Avg +1 sigma
M-5	Rx 1 Control	4	4	10	4	6	6	6	9	6.13	2.30	3.83	8.42
M-4	Rx 2 NPBC-r	6	7	10	7	6	9	5	10	7.50	1.93	5.57	9.43
M-3	Rx 3 NPBC-a	5	6	11	8	5	7	7	9	7.25	2.05	5.20	9.30
M-2	Rx 4 NPxC-r	7	9	11	9	7	9	5	8	8.13	1.81	6.32	9.93
M-1	Rx 5 NABC-r	9	10	11	11	8	8	8	8	9.13	1.36	7.77	10.48
M-9	Rx 6 FBC-r	6	9	7	7	6	10	6	9	7.50	1.60	5.90	9.10
M-11	Rx 7 FBC-a	4	8	6	6	3	7	4	9	5.88	2.10	3.77	7.98
M-10	Rx 8 NPBI-a	5	8	6	12	5	7	8	9	7.50	2.33	5.17	9.83
M-8	Rx 9 NP4xC-r	4	5	6	8	2	9	9	9	6.50	2.67	3.83	9.17
M-6	Rx 10 NPBI-r Rx 10	3	8	7	5	4	7	5	9	6.00	2.07	3.93	8.07
	STD 40 ppm	5	5.5	3	4	3	3	5	6	4.31			
Std 5 Average		5.40	7.55	7.80	7.70	4.90	7.60	6.20	8.60	6.83			
Concentration, mg/L Butanol		2.5	5	10	20	40	78	156	313	625	1250	2500	5000
Jar #		1	2	3	4	5	6	7	8	9	10	11	12

One-way ANOVA: Jan Rctr Odor versus Rctr No.

```
Analysis of Variance for Jan Rctr
Source     DF        SS        MS        F        P
Rctr No.    9     77.20      8.58     2.04    0.048
Error      70    295.00      4.21
Total      79    372.20
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  --------+---------+---------+--------
1B          8     6.125     2.295   (-------*------)
2B          8     7.500     1.927          (-------*------)
3B          8     7.250     2.053         (------*------)
4B          8     8.125     1.808             (-------*------)
5B          8     9.125     1.356                  (-------*------)
6B          8     7.500     1.604          (-------*------)
7B          8     5.875     2.100  (------*-------)
8B          8     7.500     2.330          (-------*------)
9B          8     6.500     2.673     (-------*------)
z10B        8     6.000     2.070   (------*------)
                                   --------+---------+---------+--------
Pooled StDev =    2.053                  6.0       8.0      10.0

Tukey's pairwise comparisons

    Family error rate = 0.0500
Individual error rate = 0.00169

Critical value = 4.62
```

Intervals for (column level mean) - (row level mean)

	1B	2B	3B	4B	5B	6B
2B	-4.728 1.978					
3B	-4.478 2.228	-3.103 3.603				
4B	-5.353 1.353	-3.978 2.728	-4.228 2.478			
5B	-6.353 0.353	-4.978 1.728	-5.228 1.478	-4.353 2.353		
6B	-4.728 1.978	-3.353 3.353	-3.603 3.103	-2.728 3.978	-1.728 4.978	
7B	-3.103 3.603	-1.728 4.978	-1.978 4.728	-1.103 5.603	-0.103 6.603	-1.728 4.978
8B	-4.728 1.978	-3.353 3.353	-3.603 3.103	-2.728 3.978	-1.728 4.978	-3.353 3.353
9B	-3.728 2.978	-2.353 4.353	-2.603 4.103	-1.728 4.978	-0.728 5.978	-2.353 4.353
z10B	-3.228 3.478	-1.853 4.853	-2.103 4.603	-1.228 5.478	-0.228 6.478	-1.853 4.853

	7B	8B	9B
8B	-4.978 1.728		
9B	-3.978 2.728	-2.353 4.353	
z10B	-3.478 3.228	-1.853 4.853	-2.853 3.853

NCH Biotreatment Sludge Cake Odor Panel - 1/9/2004

		panelist # 1	2	3	4	5	6	7	8	Average	StDev	Avg -1 sigma	Avg +1 sigma
C-10	**1-Control**	**3**	**7**	**3**	**6**	**5**	**4**	**2**	**7**	**4.63**	1.92	2.70	6.55
C-9	**3-NPBC-a**	**4**	**5**	**3**	**6**	**6**	**4**	**3**	**8**	**4.88**	1.73	3.15	6.60
C-4	**8-NPBI-a**	**6**	**8**	**2**	**8**	**6**	**3**	**3**	**8**	**5.50**	2.51	2.99	8.01
E-10	**1-Control**	**11**	**12**	**6**	**9**	**5**	**6**	**10**	**10**	**8.63**	2.62	6.01	11.24
E-1	**2-NPBC-r**	**12**	**9**	**12**	**10**	**7**	**10**	**11**	**10**	**10.13**	1.64	8.48	11.77
E-9	**3-NPBC-a**	**9**	**10**	**6**	**7**	**4**	**5**	**7**	**9**	**7.13**	2.10	5.02	9.23
E-2	**4-NPxC-r**	**12**	**9**	**11**	**8**	**6**	**10**	**4**	**10**	**8.75**	2.66	6.09	11.41
E-8	**5-NABC**	**10**	**11**	**11**	**10**	**4**	**7**	**7**	**10**	**8.75**	2.49	6.26	11.24
E-3	**6-FBC-r**	**11**	**9**	**12**	**9**	**5**	**8**	**4**	**9**	**8.38**	2.72	5.65	11.10
E-7	**7-FBC-a**	**11**	**9**	**9**	**10**	**6**	**6**	**4**	**10**	**8.13**	2.47	5.65	10.60
E-4	**8-NPBI-a**	**12**	**8**	**10**	**11**	**6**	**8**	**10**	**10**	**9.38**	1.92	7.45	11.30
E-6	**9-NP4xC**	**10**	**11**	**10**	**8**	**5**	**6**	**8**	**10**	**8.50**	2.14	6.36	10.64
E-5	**10-NPBI-r**	**12**	**10**	**9**	**8**	**4**	**7**	**6**	**9**	**8.13**	2.47	5.65	10.60
Average		**11.00**	**9.56**	**10.00**	**9.00**	**5.22**	**7.44**	**6.78**	**9.67**	**8.70**	1.93	6.78	10.63
Concentration, mg/L Butanol		2.5	5	10	20	40	78	156	313	625	1250	2500	5000
Jar #		1	2	3	4	5	6	7	8	9	10	11	12

One-way ANOVA: Sludge Odor versus Sludge

```
Analysis of Variance for Sludge O
Source     DF        SS        MS        F        P
Sludge     12    286.12     23.84     4.55    0.000
Error      91    476.88      5.24
Total     103    762.99
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N      Mean     StDev  --------+---------+---------+--------
No Mag 1    8     4.625     1.923  (------*-----)
No Mag 3    8     4.875     1.727   (------*-----)
No Mag 8    8     5.500     2.507      (-----*-----)
W/Mag 1     8     8.625     2.615                  (------*-----)
W/Mag 2     8    10.125     1.642                        (------*-----)
W/Mag 3     8     7.125     2.100            (------*-----)
W/Mag 4     8     8.750     2.659                   (-----*-----)
W/Mag 5     8     8.750     2.493                   (-----*-----)
W/Mag 6     8     8.375     2.722                 (------*-----)
W/Mag 7     8     8.125     2.475                (------*-----)
W/Mag 8     8     9.375     1.923                     (------*-----)
W/Mag 9     8     8.500     2.138                  (-----*-----)
W/Mg 10     8     8.125     2.475                (------*-----)
                                   --------+---------+---------+--------
Pooled StDev =    2.289                 5.0       7.5      10.0

Tukey's pairwise comparisons

    Family error rate = 0.0500
Individual error rate = 0.000998

Critical value = 4.81
```

Intervals for (column level mean) - (row level mean)

	No Mag 1	No Mag 3	No Mag 8	W/Mag 1	W/Mag 2	W/Mag 3
No Mag 3	-4.143 3.643					
No Mag 8	-4.768 3.018	-4.518 3.268				
W/Mag 1	-7.893 -0.107	-7.643 0.143	-7.018 0.768			
W/Mag 2	-9.393 -1.607	-9.143 -1.357	-8.518 -0.732	-5.393 2.393		
W/Mag 3	-6.393 1.393	-6.143 1.643	-5.518 2.268	-2.393 5.393	-0.893 6.893	
W/Mag 4	-8.018 -0.232	-7.768 0.018	-7.143 0.643	-4.018 3.768	-2.518 5.268	-5.518 2.268
W/Mag 5	-8.018 -0.232	-7.768 0.018	-7.143 0.643	-4.018 3.768	-2.518 5.268	-5.518 2.268
W/Mag 6	-7.643 0.143	-7.393 0.393	-6.768 1.018	-3.643 4.143	-2.143 5.643	-5.143 2.643
W/Mag 7	-7.393 0.393	-7.143 0.643	-6.518 1.268	-3.393 4.393	-1.893 5.893	-4.893 2.893
W/Mag 8	-8.643 -0.857	-8.393 -0.607	-7.768 0.018	-4.643 3.143	-3.143 4.643	-6.143 1.643
W/Mag 9	-7.768 0.018	-7.518 0.268	-6.893 0.893	-3.768 4.018	-2.268 5.518	-5.268 2.518
W/Mg 10	-7.393 0.393	-7.143 0.643	-6.518 1.268	-3.393 4.393	-1.893 5.893	-4.893 2.893

	W/Mag 4	W/Mag 5	W/Mag 6	W/Mag 7	W/Mag 8	W/Mag 9
W/Mag 5	-3.893 3.893					
W/Mag 6	-3.518 4.268	-3.518 4.268				
W/Mag 7	-3.268 4.518	-3.268 4.518	-3.643 4.143			
W/Mag 8	-4.518 3.268	-4.518 3.268	-4.893 2.893	-5.143 2.643		
W/Mag 9	-3.643 4.143	-3.643 4.143	-4.018 3.768	-4.268 3.518	-3.018 4.768	
W/Mg 10	-3.268 4.518	-3.268 4.518	-3.643 4.143	-3.893 3.893	-2.643 5.143	-3.518 4.268

Appendix L.
Physical Properties Estimations for EMPA, MPA and Thiolamine

The following table of physical properties estimates was developed using EPA's "PBT Profiler" (Office of Pollution Prevention and Toxics, U.S. Environmental Protection Agency).

	Log K_{ow}	VP, mmHg	Sol., %	HLC, atm-m3/mole	Log K_{oc}	BCF
EMPA[1]	-3.33	< $10E^{-6}$	>10	< $10E^{-7}$	0.3	0.5
MPA[2]	-3.89	< $10E^{-9}$	>10	< $10E^{-10}$	0	0.5
Thiolamine[3]	0.77	<$10E^{-5}$	>1	< $10E^{-12}$	2.7	0.5

1 – modeled as Na salt, pKa=4.1,
2 – modeled as Na salt, pKa 1 & 2 =3.4,
3 – modeled as ionized amine, pKaN=9.3, thiol not as Na salt, pKaS=9.7

These are ionized species with relatively high water solubility, which have little tendency to volatilize from water or environmental surfaces and little tendency to partition to organic material. Once emitted to water they will tend to remain in that environmental compartment. Hydrolysis and biodegradation reactions in water are slow, so there is the potential to persist in water. Transformation by direct aqueous photolysis is uncertain. Transformation by indirect aqueous photolysis (radical transfer) may occur, but will be slow for the phosphonic acid species, based on long half-lives for hydroxyl radical reactions (AOP). Losses due to sludge adsorption and biodegradation in sewage treatment plants are expected to be small. Reactions of the ionic species may play a role in environmental partitioning; *e.g.*, reaction with divalent cations (phosphonic acids) and cation exchange reactions (thiolamine).

These constituents of interest are not considered PBT compounds.

Using the Henry's Law Constant values for EMPA and MPA, and the wastewater concentrations estimated in Table 8, the following estimation of atmospheric emissions was made.

	Henry's Law Constant		Wastewater	Air	
	H	H' (=H/RT)	Concentration	Concentration	
	atm-m3/mole	mg/L air / mg/L water	mg/L	mg/m3	mg/m3
EMPA	<1.00E-07	<4.17E-06	36	<1.50E-01	= <0.150
MPA	<1.00E-10	<4.17E-09	28	<1.17E-04	= <0.00012

Based on the log Kow and log Koc information for EMPA and MPA there should be no tendency for these compounds to concentrate in the sludge or in receiving water sediments.